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ABSTRACT

A computer-assisted instructional program, which was developed for teaching beginning computer maintenance to employees of Unisys, covered external hardware maintenance, proper diskette care, making software backups, and electro-static discharge prevention. The procedure used in developing the program was based upon the Dick and Carey (1985) model of instructional systems development. The first of seven chapters provides an introduction to the project, including background information, a statement of the problem, the purpose of the project, and an overview of the methods and procedures employed. The next five chapters describe activities at each stage of the development process: analysis, design, development, implementation, and evaluation. The final chapter provides a summary and recommendations. Appendixes include lists of companies and vendors contacted; the project plan; pretest, posttest, and embedded test questions; sample session screens; and the post-learning questionnaire. Tables and figures appear throughout, and field test data are included. (14 references) (GL)

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AN INTERACTIVE COMPUTER-BASED TRAINING PROGRAM FOR BEGINNER PERSONAL COMPUTER MAINTENANCE

by

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State University of New York at Binghamton

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of the requirements for the degree of

Master of Science

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CHAPTER 1

INTRODUCTION

Overview

Personal Computer maintenance is one of the most important skills a user must have. Unfortunately, most PC users do not realize this until an accident has occurred which causes hardware damage or software loss. This is especially a problem in organizations which use personal computers, since damage and data loss costs the company in both money and time lost.

Some aspects of personal computer maintenance which ought to be practiced by all users include:

I. External hardware maintenance (cleaning, storage, moving)
II. Proper diskette care/handling/storage
III. Software backups
IV. Electro-static discharge (ESD) prevention

This project covers the first topic in depth.

Computer-Based Training (CBT) is an effective and interactive method to accomplish the goal of individual training in a company. Many people think that most topics are more easily learned when taught at the individual's own pace. CBT allows for this since the learner is in control of how fast or slow the lesson should proceed.

The use of a computer-based training program to teach employees beginning computer maintenance may be the most cost effective, time effective and goal effective means. A tailored program to teach individuals in a particular company such as Unisys makes this even more effective. This is so because it will include those specific topics/equipment that are the most important to the company. In addition, classrooms are not needed, nor the services of a trainer. Training can be fit into the employee's schedule. Thus this method is preferred.

Background

This designer had worked at Unisys for two years as the automation coordinator for the pilot personal computer automation project. This automation project was first proposed by a quality circle in Sperry Corporation before it became Unisys Corporation and before the designer was employed there. After those first two years, this designer continued to work on a variety of projects. She saw first hand the results of poor personal computer maintenance. Floppy disks were ruined and data was often lost. No training was provided to her or to her colleagues on this topic. When it was time to decide on a project for graduate school, this designer chose to develop a computer-based training course to teach the beginner about personal computer maintenance.

Statement of the Problem

New Unisys employees or current employees who have never used a Unisys personal computer or any personal computer are often ignorant of the proper hardware maintenance procedures to follow. They do not know the procedures to ensure smooth trouble free operation of the equipment. Training is sometimes provided formally or informally for various software packages or application programs. However, this is not true with maintenance. Sometimes a personal computer workstation will be delivered to an employee's desk unassembled and that employee will have to connect the components without assistance. Problems occur when employees don't use surge protectors or don't pack the components properly before moving them. Employees often eat at their desks and when soda or coffee spills on their keyboard or printer, expensive damage can ensue. Regular disk drive maintenance is important or read/write errors will occur and data will be lost in addition to valuable work time. Unisys could save a lot of time and money if every employee was more aware of proper hardware maintenance and practiced it. However, there is no formal training course available that would inform them of these vital facts and procedures. An in-class training program would not be as effective since the range in knowledge of the topic by the potential students is so large. In addition, the amount of administrative time to prepare the course and class list and keep track of progress is also prohibitive. A one-on-one interactive self-paced computer-based tutorial is most appropriate for effective and efficient training.

Purpose of the Project

The purpose of this training program is to reduce the amount of waste, both in time and dollars, at Unisys due to poor personal computer maintenance. In addition, employees who participate in the training will be left with a more complete understanding and appreciation of the personal computer. Hopefully, they will also feel more at ease when working on it.

Definition of Terms

The following definition of terms is provided to assist those who may be unfamiliar with them in understanding this document.

Author Language - a computer language used specifically for creating CAI courseware. For example: PILOT, rather than FORTRAN. (Reynolds, 1987)

Authoring System - special type of program that facilitates the programming of CAI courseware by enabling a content expert to interact with the computer and have the coding performed automatically Unlike an authoring language, it does not require programming knowledge or skill. (Reynolds, 1987)

CAI - abbreviation for Computer Assisted Instruction. The use of a computer to deliver instruction. The modes of CAI are drill and practice, modeling, instructional games, tutorial and simulation. (Reynolds, 1987)

CBT - abbreviation for Computer-based Training. (Reynolds, 1987)

Courseware - term used to describe those computer application programs, as well as other media such as texts and video, that support educational objectives. (Reynolds, 1987)

Diskette - a small magnetic media disk, typically used for microcomputer information storage. (Reynolds, 1987)

DOS - acronym for Disk Operating System. The operating system is the software that makes the computer and the disk behave properly and usefully. (Reynolds, 1987)

Learner - the preferred term for adult students. (Reynolds, 1987) The learners in this project are Unisys employees.

Menu - a list of choices available for a student, or utilities available for an author or computer user. (Reynolds, 1987)

Personal Computer - term used to describe either a microcomputer or a minicomputer, that is intended for use by only one person. (Reynolds, 1987) In this project, a Sperry or Unisys Personal Computer is used and consists of the monitor, system unit, diskdrives, keyboard and printer.

Tutorial - the most typical type of CAI. The program and the learner interact one-on-one. Ideally, the process advances just as the best tutor might personally conduct the process. (Reynolds, 1987)

Unisys - refers to the Shipboard and Ground Systems Group within the Defense Systems Division of Unisys Corporation. This group is located at Marcus Avenue, Great Neck, New York, 11020. This group is typical of the entire corporation with regard to the use and personal maintenance of personal computers.

User-friendly - a desirable attribute for any computer system. Implies that the user need not be an expert merely to use the system and that mistakes are easily overcome or avoided by the system. (Reynolds, 1987)

Assumptions

1. That the participants of this training program are Unisys employees.

2. That the equipment used to carry out the training is an

IBM compatible, Sperry, or Unisys personal computer.

3. That practicing proper personal computer hardware maintenance will reduce costs, both in time and dollars, due to malfunction.

Limitations

1. That the audience of this project consists of Unisys employees and may not be suitable without revisions for other companies or individuals.

2. That this computer-based training program has only been tested and intended to work on Sperry/Unisys/IBM personal computers with 640K memory.

3. That the purpose of this project can only be realized if participants put to use what they have learned.

Methods and Procedures

The method and procedure used in developing the computer-based training program was based on the model of instructional systems design and development (ISD) described by Dick & Carey (1985). The different phases are: analysis, design, development, implementation, and evaluation. The five phases are described below.

Analysis

The designer observed the present practices, formal procedures, past training and habits of Unisys employees concerning personal computer maintenance and training. In addition, the designer conducted informal interviews, of a conversational type, to determine the attitudes and skills of the possible training participants. The designer also sought the available literature and training materials on the topic of personal computer maintenance. Thus, analysis of the training problem and possible solutions was conducted by observation, interviews and library research.

Design

This computer-based training program was designed by determining the entry behaviors and characteristics required, the performance objectives, and the criterion-referenced test items. The performance objectives were broken down into three parts: the behavior the learner is expected to perform; the conditions under which performance will be carried out; and the criteria for success. (Dick & Carey, 1985). A design document was also written.

Development

The designer produced the screens for the computer-based training program. An authoring language program was chosen based on various factors after careful analysis of what was available. The Unison authoring language was then learned and the designer, using this language, programmed the computer-based training program. Included were the pretest, required learning material and embedded tests. In addition, a method for keeping track of the learner's score was also programmed.

Implementation

Field trials were conducted and the designer collected data during each training session. The data consisted of the time spent during instruction, the scores of the pretest and if necessary, the embedded tests. In addition the results of the post learning questionnaire and other problems, comments or criticisms of the program were collected.

Evaluation

The formative evaluation was conducted in three phases: one-on-one trials, small group trials, and field trials. Improvements were made to the program after each trial. The summative evaluation was written as to what could have been had Unisys decided to implement the program. The designer also developed a post-learning questionnaire to determine the learner's reactions to the instruction and the material.

Summary

Unisys employees need to learn the proper way to care for, use and maintain their personal computers. By effectively maintaining their hardware, time and money can be saved. In the past, no training was provided by Unisys concerning the maintenance of the personal computer. This designer chose the ISD model to design and develop this project. The mode of teaching is computer-based training and the language it is written in is the Unison authoring language.

CHAPTER 2

ANALYSIS

Introduction

The analysis for this project was done so the designer would be sure that the project chosen was necessary and would solve an existing problem. A training need exists when an employee lacks the knowledge or skill to perform an assigned task satisfactorily (Laird, 1985). Analysis was also done to determine if there was a training need or a performance problem. Analysis was the first phase in designing and developing this computer-based training program.

Needs Analysis

The discrepancy between how Unisys personal computers were maintained by new and current employees and how they should have been maintained was obvious in a variety of ways. Employees often had to use workstations other than their own because of hardware that was broken or malfunctioning due to poor maintenance practices. In addition, many poor maintenance practices were evident that did not cause damage but had the potential to do so easily. For example, many employees drank coffee near their personal computers while they worked on them. The designer researched how personal computers should be maintained and observed this discrepancy. In addition, the designer analyzed the training needs, defined the needs and constraints, and analyzed the target population. This analysis was done by informal observation, interviews and library research.

Job Task Analysis

The designer researched beginner personal computer maintenance procedures and determined what tasks would be included in the lesson. The information included teaches the learner the parts of the personal computer; what to do when the computer is not in use; what to do when moving the personal computer; how to clean the various components, especially after an accident or spillage; and other maintenance facts. For more detail see the Instructional Task Analysis in Chapter 3. The domain is intellectual and verbal skills.

Target Population Analysis

The target population for training consists of Unisys (formerly Sperry) Corporation employees, both new and current, at the Great Neck location, who either will or currently work on or near a personal computer. The amount of education each employee in the target population has varies from a high school education to a post-doctoral education. The amount of knowledge each employee has concerning the personal computer and personal computer maintenance also varies. This knowledge does not necessarily depend on that employee's other formal education. The age of the target population ranges from eighteen to sixty-seven years of age. The ratio of males to females is approximately 60:40. The races of the members of the target population are varied as are the religions. There are approximately forty-seven hundred people in the target population for this training.

Organizational Constraints

Unisys has many rules and procedures that do not allow this computer-based training program to be fully implemented. It is because of this that financial savings due to training can only be guessed. Individuals' supervisors must approve all training and some will approve and some will not. Therefore, training would not be uniform and damage might occur due to poor maintenance habits by an untrained employee. Also, all software must be approved by many levels of management before it can be used. In addition, since Unisys is a government contractor, all time spent on training must come from overhead, or the company's profit. The other major constraint, aside from organizational policy, is due to equipment. Since all employees use either Sperry or Unisys (or in rare cases, IBM) personal computers, this computer-based training program was designed to train employees about maintenance for these machines only. This is because these personal computers are different from other micro computers which might have different components. In addition, all lessons must be delivered on these machines.

Instructional Goal

The broad instructional goal is for the learner to know how and when to perform personal computer hardware maintenance procedures. The purpose of this instruction is to reduce time and money lost due to poor maintenance habits. Specifically, after completing this computer-based training program, the user will be able to: 1) identify the various parts of the personal computer; 2) state the procedures to follow when the personal computer is not in use, and the procedures to follow when moving the personal computer; and 3) state the procedures for cleaning the various components and conducting other miscellaneous maintenance procedures.

The instructional goal consists of both intellectual skills and verbal skills. This is because the user will be asked to identify as well as remember facts and make judgements. When there has not been an obvious accident to a component, the user will have to judge when cleaning should carried out and to which component. This is an example of intellectual skill since it involves solving a problem. The user will be expected to be able to identify the various parts of the computer, know the do's and don'ts of hardware maintenance and know the procedures for moving the personal computer. This is mostly memorization, and therefore falls into the category of verbal skill.

Major Tasks and Topics

The major tasks and topics of this instructional program are as follows:

1. State parts of the personal computer
2. State what not to do when computer is not in use
3. State what to do when moving the personal computer
4. State how and when to clean the parts of the personal computer
5. State the various other hardware maintenance procedures

Media Requirements

The specific requirements for media are that this instructional program will be a computer-based training program and will be written in an authoring language. The language used will be the Unison authoring language. The program will be run on a personal computer with at least 640K, and will be either IBM compatible or a Sperry or a Unisys personal computer.

Expected Outcome Levels

All Unisys employees who use or work near a personal computer will be expected to pass either the pretest or the embedded tests in this instructional program. If they fail the pretest, they will be required to go through the lesson. If they fail the questions in the lesson, they will have to either retake the instruction or do other remedial training at the discretion of that person's supervisor. The criteria for success is that the learner correctly answer at least six out of eight pretest questions or at least twelve out of fifteen embedded tests. No post test is given since this would cause too much repetition of questions.

Literature, Existing Courses, and Material Review

A review of the literature and a survey of existing courses and materials was conducted while the designer was enrolled in the New York Institute of Technology's Resources in the Training Field course. Many different types of research was carried out. Literature and materials were found on the topic of personal computer maintenance, however, no courses were found on this topic.

Related theory

The Texwipe Company, Upper Saddle River, NY, supplied the designer with literature regarding personal computer maintenance. This company manufactures preventive maintenance products for the electronic service industry and personal computers. Service managers agree that preventive maintenance should be performed; the question is how often and when. It is recommended by service managers and technicians that cleaning of peripherals and the main unit should be done on a regular basis depending on how often it is used. The average figure given for recommended hours between cleanings was 52.7 hours of use. Two-thirds of the technicians surveyed in one article said that personal computers should have their disk drives cleaned at least once a month. Any part should be cleaned immediately if there is a spillage or that part is malfunctioning.

Literature review

The designer did research regarding literature on the topic of personal computer maintenance for beginners. Various articles and manuals were referenced for information for this computer-based training program. In addition a literature search was conducted electronically at the NYIT library. This bibliography was compiled from the findings of BRS Information Technologies and DIALOG Information Services, Inc. The identifier Maintenance yielded 704 sources. The identifier CAI or CBT yielded 2,586. When combined, it resulted in 15 sources. This was the result of the search from DIALOG. The search from BRS resulted in the following. The identifier Personal Computer Maintenance yielded 50 sources. The identifier CAI or CBT yielded 10,772 sources. When combined, it resulted in eight sources but only three from within three years. This was from ERIC. CMPT produced these results: Personal Computer Maintenance yielded 324 sources; CAI or CBT yielded 4,704 sources.

When combined, it resulted in 13 sources. The following are the most informative and fruitful sources:

1. **Preventive Maintenance: Advice from the Field** (Roche, K., 1987)

This article discusses how often personal computer components should be cleaned and also lists percentages related to malfunction versus cleaning. Dust covers, static damage and descriptions of cleaning kits were also described in this article.

2. **Make a Plan for PC Disaster Recovery** (Yaremko, J., 1988)

This article from The Office magazine deals primarily with making back-ups of all software and data regularly. The topics concerning this project that were also included were: the use of surge protectors; parking hard disk heads and floppy disk care and storage.

3. **PC Care Manual: Diagnosing and Maintaining your MS-DOS, CP/M or Macintosh System** (Morrison, C. & Stover, T., 1987)

This book covers every component of the PC system. It describes preventive maintenance and general everyday practices to help keep the PC healthy. It also includes pictures of each component and commonly used maintenance equipment and supplies. It explains repair guidelines and gives directions and illustrations on making repairs and adjustments to the PC.

4. **How to Run a Hard Disk PC** (Wrona, T., 1988)

This book discusses everything a user needs to know about running a hard disk on a PC. Some of the main topics are the park command, the format command, files, paths, batch files and hard disk drive maintenance.

5. **Hands on: Clean Your Computer and Look Around Inside** (Beechhold, H. F., 1985)

The is the second article in a six-part series on computer maintenance and repair. This article discusses how to clean the computer, the functions of its components and the chips on the motherboard. Included are five illustrations.

6. **Commodore 64 Troubleshooting and Repair Guide** (Brenner, R. C., 1985)

This is a beginner's book and is very easy to understand. It provides the user with a detailed troubleshooting guide and instructions for repair.

7. **Choosing Software for a High School Chemistry Class** (McCollom, P. D., 1985)

This article presents an overview of how software was used to augment a high school chemistry class. It describes the problems of hardware and software selection and maintenance.

8. **Hands on: Getting Started as a Computer Tinkerer** (Beechhold, H. F., 1985)

This is the first article in a six-part series on computer maintenance and repair. It discusses the necessary tools and supplies needed for maintenance and repair of most personal computers. It includes thirteen illustrations.

9. **The Plain English Repair and Maintenance Guide for Home Computers** (Beechhold, H. F., 1985)

This book is intended for beginners who want to learn to repair and maintain their home computer. It offers readers programs for the upkeep of their home computers and also contains three illustrations and one photo.

10. **CoCo Mechanic: Simple CoCo Repairs are No Trouble at All** (Tymony, C., 1985)

This article describes how to make simple repairs to the TRS-80 Color Computer. It discusses tools, preventions and troubleshooting. It includes eleven figures.

11. **CAL System Costs: Present and Future** (Pressman, I., Rosenbloom, B., 1984)

This article discusses the costs of using computer-assisted instruction. Included is a discussion on the costs of training users and other staff, the acquisition of hardware and software and their installation and maintenance costs. This article also considers the potential savings.

12. **Motivating Maintenance Personnel** (Couger, J., 1985)

This article reports that computer maintenance work has only one-half to two-thirds the motivating potential of other programming/analysis work. It discusses in detail how to manage an MIS department for maximum productivity. It contains three graphs and one illustration.

13. **Tape Reliability** (Tenny, R., 1983)

This article discusses the care and feeding of cassette tape storage media. It includes a discussion of tape signals, recorder evaluation and maintenance. These techniques can be applied to other electronic storage media.

14. **Surge Suppressors: An Ounce of Prevention...** (Wiswell, P., 1986)

This article begins with a typical PC disaster scenerio in which the author loses all of his data during an electrical storm. The author continues by describing how it could have been prevented with the use of a surge suppressor. Various models and styles and proper hookup are discussed. Illustrations are included as well as prices and vendors.

The designer received the most information from a few of these sources. She extracted information concerning the cleaning of components from the Roche article, the Morrison & Stover book, and the Beechhold article. Information regarding surge suppressors was found primarily in the Wiswell article. The Morrison & Stover book and the Beechhold articles provided extensive information on the components of the PC and various miscellaneous maintenance procedures. The Wrona book gave the designer information on hard disks and the park command.

Survey of existing courses and materials

The designer found no existing courses and few materials on the topic of personal computer hardware maintenance. The most comprehensive information was found from manufacturer's of maintenance supplies. In addition, no computer-based training programs could be found on that topic. The designer contacted software vendors known for training programs concerning personal computer related topics. The companies and points of contact were obtained from Training magazine's Marketplace Directory 1987-1988. See Appendix A. Some of these vendors commented that such a program would be a good idea but they did not have software or training materials. The materials that exist on this topic are not intended as training materials, therefore, they can not be compared to this project. The following are the materials obtained from vendors of computer maintenance equipment:

1. **Read/Right: Precision Cleaning Solutions for Computers and Electronic Office Equipment** (TexWipe, 1988)

This manual was supplied by the Texwipe Company and includes discussion of these six problem areas and solutions: dirty read/write heads; static; dirty CRT screens; dirty printers; general dust and dirt. There is also a section on Cleaning products for mainframe and minisystems; cleaning products for copiers and typewriters; premoistened pads; solvents and cleaning solutions; counter displays; and bio-safe personal care products.

3. **Contemporary ComputerWear** (McCarthy, 1988)

This flyer discusses the need for dust covers for personal computer components as well as the proper material that should be used. Covers should breathe and be static-free.

4. **The Care and Feeding of your Computer and office equipment** (TexWipe, 1987)

This booklet is presented as a public service by Read/Righ company. It deals with the topics of cleaning disk drives, crts, keyboards, printers and the housing of the components. For each component, there is a discussion on the proper way to clean it and the various cleaning products that are available and should be used. Finally, there is an overview of the available cleaning products made by the Texwipe Company.

Plan for Design and Development Effort

Project Plan

The PERT planning technique was used to chart milestones and deadlines. This was done to minimize delays and conflicts of tasks. At the analysis phase of this project, the designer still had to design, develop, implement and evaluate the instructional program. See Appendix B for the PERT charts. A design document was written during the design effort before any other design work was done. See Appendix C for this document.

Budget

A budget was determined for the cost of this project. Included are start-up costs, designer costs, equipment and software costs as well as the cost for the Unisys employees taking the course since their salaries had to come from overhead expenses as opposed to a government contract. In addition, the amount that Unisys could save due to successful implementation of this program is also included. Although no actual compensation occurred, and the costs for these items fluctuate, they have been estimated based on 1988 prices and wages. See Table 1 for this budget.

Summary

The designer analyzed the audience, the instructional goal, the existing materials and literature and the budget for this project. She found a variety of literature on the topic of personal computer maintenance for the beginner. Books, magazine and journals provided some sources, and the designer found additional literature on this topic from the manufacturers of cleaning and maintenance supplies. A budget was determined based on 1988 prices and wages for Unisys employees.

Table 1

PROJECT COST

Equipment cost:
equipment and maintenance ($1/hr)

15 employees times 1 hour total time on PC	$15
100 hours to develop and modify	$100

Labor cost:

Labor rate $20/hour	Analysis	Design	Development	Implement	Total
Designer (hours)	40	60	90	30	220
Designer ($)	$800	$1,200	$1,800	$600	$4,400
Participants (hours)	0	0	15	0	15
Participants	$0	$0	$300	$0	$300
Total dollars	$800	$1,200	$2,100	$600	$4,700
Grand Total	$4,700				
Including Equipment	$4,815				

CHAPTER 3

DESIGN

Introduction

The design phase of this project consisted of an instructional task analysis, determination of instructional objectives, the definition of entry behaviors, the identification of group and sequence objectives, the specification of learning activities, the assessment system, the evaluation system, the learning transfer system, and a review and selection of existing materials.

Instructional Task Analysis

The instructional goal was determined in the analysis phase. The domains of learning are intellectual skill and verbal skill. The designer conducted an instructional task analysis to determine the major topics that the Unisys employees will need to cover and learn to realize the instructional goal. In addition, subtasks were also identified for each task. In this project, only the first task was required to be presented before the others. The order of the other tasks was not as crucial. The tasks and subtasks are listed below.

- Naming the parts of the personal computer
    1. monitor
    2. diskdrives
    3. system unit
    4. keyboard
    5. printer

- What to do and not do when the PC is not in use
    1. cover PC

    2. don't treat like furniture (pile books on top of)
    3. don't keep disks in disk drives

- What to do when moving the PC
    1. A short distance
        a. turn if off
        b. secure loose parts
        c. cover or wrap delicate parts
        d. park hard disk head
        e. place cardboard or blank disk in drives and close doors
    2. A long distance
        a. wrap in original packing materials and boxes
        b. follow manufacturer's instructions for packing

- How and when to clean different parts of the PC
    1. monitor
    2. keyboard
    3. printer
    4. housing of the components
    5. disk drives

- Other do's and don'ts
    1. don't smoke, eat or drink near PC
    2. do clean PC regularly or immediately if spillage
    3. do use surge protector
    4. do keep PC away from heat sources

Instructional Objectives

The instructional objectives are in the form prescribed by Mager. They are used to determine the expected results of instruction. It was suggested by Mager (1984) that each instructional objective include the conditions, the expected performance and the criteria for success. The instructional objectives for this project are:

Given:

> a graphic representation of a personal computer component, and a list of the names of all of the components, the learner will be able to correctly name that component graphically depicted, and

given:

a statement about what to do when the computer is not in use or what to do or not do when moving the personal computer, the learner will be able to state whether that statement is true or false, and

given:

a list of problems and solutions concerning what part to clean when a certain problem has occurred, the learner will be able to correctly match the problem with the solution, and

given:

an incomplete statement concerning other personal computer maintenance tips, the user will be able to fill in the blank such that the statement is correct,

such that:

the combined score attained is at least twelve out of fifteen.

Entry Behaviors Defined

Entry behaviors are important in the design process. There must be a minimum level of knowledge that all of the learner's possess such that the designer need not worry about teaching that prerequisite skill. The entry behaviors of this project are listed below. All participants must be:

1. a high school graduate or have an equivalency diploma.
2. able to type (any level is acceptable).
3. able to see normally.

4. able to spell on a sixth grade level.
5. Unisys employees.

Group and Sequence Objectives

The Unisys employees who are participating in this project must do the following in the sequence shown in order to achieve the instructional goal.

1. Identify the parts of the personal computer.
    1.1 Monitor.
    1.2 Diskdrives.
    1.3 System unit.
    1.4 Keyboard.
    1.5 Printer.
2. State what to do and not do when the PC is not in use.
    2.1 the PC should be covered.
    2.2 the PC should not be treated like furniture.
    2.3 disks should not be kept in the diskdrives.
3. State what to do when moving the PC a short or long distance.
    3.1 the PC should be turned off.
    3.2 the loose parts should be secured.
    3.3 delicate parts should be covered or wrapped.
    3.4 the hard disk head should be parked.
    3.5 cardboard or a blank disk should be inserted in the drives and the doors should be closed.
    3.6 all components should be wrapped in original packing materials and boxes.

3.7 the manufacturer's instructions for packing should be followed.

4. State how and when to clean the different parts of the personal computer.
    - 4.1 how and when to clean the monitor.
    - 4.2 how and when to clean the keyboard.
    - 4.3 how and when to clean the printer.
    - 4.4 how and when to clean the housing of the components.
    - 4.5 how and when to clean the disk drives.

5. State the other do's and don'ts concerning PC maintenance.
    - 5.1 should not smoke, eat or drink near the PC.
    - 5.2 the PC should be cleaned regularly or immediately if an accidental spillage has occurred.
    - 5.3 a surge protector should be used.
    - 5.4 the PC should be kept away from heat sources.

Learning Activities Specification

The learning activities were determined according to the instructional objectives. See Table 2 for the learning activity instructional strategy matrix which shows the content, instructional method, and media for each learning activity. This table was based on Anderson's (1983) book on selecting and developing media for instruction. The embedded tests after each learning activity reinforce, as well as test, what has been learned. This lesson follows Gagne's (1985) steps of instruction.

Table 2

Learning Activity Instructional Strategy Matrix

Learning Activity	Content	Instructional Method	Media
1.1 - 1.5	Identify parts	Graphics supported text	Computer
2.1 - 2.3	PC not in use rules	Text	Computer
3.1 - 3.7	Moving rules	Text	Computer
4.1 - 4.5	Cleaning parts rules	Graphics supported text	Computer
5.1 - 5.4	Misc. rules	Text	Computer

Assessment System Specification

The designer chose to measure the learning at the time of instruction through the use of a pretest and embedded tests. A post test was not used since there was not enough material in the lesson. If a post test had been included, many of the questions would have been redundant of earlier ones and not true indicators of learning. The assessments will be administered before instruction in the case of the pretest and during instruction in the case of the embedded tests. The scoring will be pass/fail as follows: in order to pass the pretest and skip the lesson, the learner must correctly answer at least six out of eight questions;

in order to pass the embedded tests and thus pass the lesson, the learner must correctly answer at least twelve out of fifteen questions. The pretest will be used to determine who needs to proceed with the lesson. The embedded tests will be used to see that the learner understands the various maintenance procedures for personal computers. If an employee does not pass the pretest or the embedded tests, it will be up to the discretion of that employee's supervisor to determine if additional instruction is needed. Also, if additional instruction is necessary before that employee is allowed to use or work near a personal computer. After instruction a post learning questionnaire will be administered to reveal reactions to the lesson.

Pretest

The pretest is optional for the employee. If the employee does not chose to take the pretest, that employee must proceed with the lesson. The pretest consists of eight fill-in-the-blank type questions. Various answers and various spellings of those answers to the same question will be accepted. This is so that the pretest actually tests the learner's knowledge of the subject matter and not just that learner's ability to spell. After the learner has completed the pretest, it is scored electronically and the learner is either sent to the beginning of the lesson, or the end, depending on the results. The pretest is included so that the time of an employee who is knowledgeable on the topic of personal computer maintenance is not wasted. See Appendix D for the questions included in the pretest.

Embedded Tests

The embedded tests consist of a variety of questions presented to the learner after each learning activity has been taught. After the learner has been presented with the parts of the personal computer, an embedded test consisting of matching questions is given. After activities two and three, an embedded test is administered which consists of four true/false questions concerning rules about moving the PC and rules about when it is not in use. After the fourth activity which consists of cleaning the parts of the PC, an embedded test is given which consists of matching the problem with the correct solution. After the last activity, the embedded test consists of three fill-in-the-blank questions. There are a total of fifteen questions in the embedded tests. See Appendix E for the questions included in the embedded tests.

Post Learning Questionnaire

A questionnaire will be given to each participant after the instructional program has been completed. The questionnaire consists of a variety of questions concerning reactions, attitudes and other demographic information. The questionnaire will be used during the formative and summative evaluations so that the designer can make changes to the program based on results as well as measure the reaction to the lesson.

Evaluation System Specification

The designer decided to conduct both a formative evaluation and a summative evaluation. The formative evaluation will be done during the development of the computer-based training program.

This way necessary changes that have been brought to light from the evaluation can be incorporated into the program. Parts of the summative evaluation will be conducted during and after the implementation of this project to measure the absolute effectiveness of instruction. The behavior and results/impact levels will be projected as to what could be.

Formative Evaluation

The formative evaluation consists of three phases. They are the one-on-one trials, the small group trials, and the field trials. The results of these trials will be used to change and improve the computer-based training program.

Summative Evaluation

The summative evaluation as described by Kirkpatrick (1987) consists of four levels. They are the reaction, the learning, the behavior and the results/impact levels. During and after implementation, the summative evaluation will be conducted. The results/impact level will not be done since full implementation of this project is restricted by organizational constraints. Instead, the designer will project the results/impact of this project. In the reaction level, the designer will assess the participants' reactions through the use of the post learning questionnaire, discussion and observation. The learning level will be measured through the use of scores from the pretest and embedded tests. The behavior will be observed shortly after participation in the instructional program.

Learning Transfer System Specification

According to Broad (1988), the transfer of training to the job is best achieved by the full participation of the organization (managers, supervisors), the trainer and the trainee. Each person should perform several actions before, during and after training. Unisys has several personal computer related courses. From observation, it has been noted that there is little transfer of learning to the job. This is because most learning concerning the PC is done haphazardly and on the job. Formal training has not been effective. Management has implemented few of the items suggested by Broad. They have, however, in some instances, done the following concerning PC training courses:

- reviewed instructional content for relevance
- monitored attendance of trainees at all training sessions
- included new skills in trainee's performance standards

It is recommended that to ensure transfer of training to the job after the implementation of the PC Maintenance Training Program, the following actions be done by the managers and supervisors at Unisys according to Broad's (1988) model.

- participate in training
- require and support training for all employees who work with or near computer equipment
- get baseline performance data (PC repair/failure reports) before training
- allow employees time to participate without interruptions
- keep records of successful completion of training in employee's folder

- have trainees participate in work-related decisions regarding PC maintenance schedules in their area
- assign a trained employee in each section to be the PC maintenance coordinator responsible for helping new trainees, until everyone has been trained
- track post training performance data and compare to baseline data; arrange further training or investigation if little or no significant improvement has been made
- offer incentives to those areas which have significantly lowered the repair/failure reports from that area
- update training as equipment changes or requirements change

Review and Selection of Existing Materials

None of the existing materials identified in the analysis phase were deemed appropriate for inclusion in this project. Information was obtained from some of the sources but this was used for the subject matter only.

Summary

The designer conducted an instructional task analysis, identified the instructional objectives, entry behaviors, group and sequence objectives. The learning activities, assessment system, evaluation system, and learning transfer system were specified. A formative and summative evaluation will be done. However, the last level of the summative evaluation will be predicted since Unisys organizational constraints prevent full implementation of this project. The designer reviewed and did not select any existing materials for inclusion in this project. It was determined that a self-paced computer-based training program would be developed for training Unisys employees on the topic of personal computer maintenance for beginners. A pretest and embedded tests will be included in this program. In addition, this computer-based program will compute the scores of these tests.

CHAPTER 4

DEVELOPMENT

Introduction

In the development process, the designer developed the learning activity scheme and the learning activities. In addition, the learning activities and materials were reviewed and the actual instructional materials to be implemented were produced for evaluation. The learning activities were based on Gagne's (1985) events of instruction. The materials were developed in steps. Since the medium used is computer-based, screens had to be produced on paper before programming could begin.

Learning Activity Development Scheme

The designer used a scheme to develop the learning activities that was based on top-down design. This programming design scheme was used to develop one lesson in the learning package. The other lessons that were described in the Design Document were to be developed pending the success of the first module. The first lesson is what comprises this project. Top down design requires the designer to examine the overall objectives and then break them down into tasks. These are then broken down until each piece is a subroutine or screen. A subroutine is a small segment of code that produces a screen or part of a screen. In this project some screens have separate subroutines. Other screens are comprised of a few subroutines. In most cases, there are a few generic subroutines that are called from within other subroutines.

Learning Activity Development

The designer chose the medium of computer-based training for this project. Because of this, the procedure followed is similar to that used by typical computer programmers. The designer first determined the instructional goal and objectives. A flow diagram of the program was not formally done because the designer thought that this step could be easily skipped. She subsequently realized that this was a mistake. Had the designer completed a detailed flow chart diagram of each screen, the next step would have been easier. The designer determined the layout of text and length of presentations according to Alessi and Trollip (1985), Steinberg (1984) and Hannafin and Peck (1988). The designer then produced the screens on paper. Each page included the following information so that it would be programmer ready. See Appendix F for the programmer ready screens.

Lesson name - the name of the overall lesson in which the screen resides. In this project, some screens are part of the INTRO lesson. Most screens are from the HARDWARE lesson.

Unit name - each screen has a unit name associated with it. In most cases, this also corresponds to the subroutine that produces that screen.

Contents of the screen - a drawn or written depiction of how the screen will look on the computer monitor.

Programmer directions - any special directions for the programmer concerning counters for correct answers or special display instructions.

Correct answers - the correct answers to the questions for those screens which test the user.

Branching instructions - instructions to the programmer which state which screen should appear next when the user presses certain keys. The next screen can also depend on whether the user answers the questions correctly on those screens which test the user.

The designer then chose an authoring language package based on various factors. The Unison authoring language was chosen based on price, flexibility and other factors. See Appendix G for the comparison matrix. After the package was chosen and purchased, the designer learned the programming language. Program code for this project was then written. See Appendix H for the original program code. The designer learned during the coding phase that the screens developed on paper could not all be reproduced on the personal computer. In addition, the designer did not look into the graphics ability of the various packages enough. As a result, the graphics in this project are not what they could have been or what the designer had hoped they would be. This was an important thing to learn. Since completion of this project, the designer learned that Unison Draw is available to use to produce graphics.

In developing the learning activities in this project, the designer based the instructional events on the nine events of instruction. (Gagne, 1985).

1. Gaining attention - The designer made an introduction menu to introduce the learner to the lessons available.

2. Activating motivation - The designer precluded each learning activity with a title or screen stating what would be learned.

3. Stimulating recall of prior learning - The designer attempted to incorporate analogies of things the user already knew to better understand what was being taught.

4. Presenting the stimulus - The designer programmed this project to go forward or backward at the student's own pace and request. The information is presented screen by screen or paragraph by paragraph.

5. Providing learning guidance - The designer programmed this project to give examples and sometimes graphics of what was presented. In addition, feedback for correct and incorrect answers was provided.

6. Eliciting performance - The designer integrated embedded tests into the program to elicit performance after each instructional task.

7. Providing feedback - Feedback is provided to the learner after each embedded test. The learner will be reinforced by positive comments if a correct answer has been given. The learner will be given the correct answer if it has not been given.

8. Assessing performance - The learner's performance will be assessed both by the pretest and the embedded tests.

9. Enhancing retention and transfer - Embedded tests and feedback enhance retention and transfer of the instructional tasks.

Learning Activity Review

After the development of the computer-based project, the materials were reviewed by the subject matter expert. Professor Yens from the New York Institute of Technology acted in this capacity. Professor David Yens offered advice concerning the terminology used in this project. It was determined that the Unisys terminology would prevail since the project's audience was used to this terminology. The designer performed an editing type review to ensure that all parts of the instruction were present and that they formed a complete product responsive to the design. The grammar, style and punctuation were checked by Mrs. Ellen Summers, an adjunct professor of English at C. W. Post college, and coincidentally the mother of the designer. The accuracy of the materials was also checked and confirmed at this time.

Materials for Evaluation Produced

Three sets of materials were produced for the evaluation process. One set consisted of the set to be used during the summative evaluation. The other two sets served as backups. A set consists of the computer-based lesson and the delivery program to run it. The designer could not produce more sets of materials due to the nature of the licensing agreement with Courseware Applications, the copyright owner of the Unison authoring language program. If there was not a licensing agreement, numerous copies of the delivery program could be made, rather than bought and Unison would not make a profit. Printouts of screens of a sample session were produced as hardcopy. The attitude questionnaire was produced for the fifteen people who participated in the training. See Appendix I for the sample session screens. See Appendix J for the post learning questionnaire.

Summary

The instructional materials were developed based on the method typically used by programmers, top down design. Programmer ready materials were produced before coding commenced. The nine events of instruction were used to develop the instructional events. The materials were reviewed by the subject matter expert and an English expert. A computer-based training subject matter expert confirmed the effectiveness and accuracy of the instructional materials. An English expert confirmed that the grammar, punctuation and style were correct. Three sets of the computer-based program and delivery program were produced. Fifteen sets of the attitude questionnaire were produced.

CHAPTER 5

Implementation

Introduction

During the implementation phase of this project, the designer reproduced the computer-based training program and delivery program in "market ready" form. She delivered the instruction to members of the target population who were asked and willing to participate. After each training session, she collected data for the summative evaluation. The data consisted of the comments and problems expressed by the Unisys participants, as well as their scores on the tests. The designer also collected data pertaining to the amount of time spent during the lesson.

Materials for Implementation Reproduced

Three sets of the computer-based program for this project were produced. In addition, three copies of the delivery program required to run the instructional program were produced. Two sets were backups while one set was actually used. The designer also produced six post learning questionnaires to be completed by each participant after the training. After each of four one-on-one trials and after all five of the small group trials, the computer-based program was revised. The final version was produced three times to replace the older versions. The source code of the final version is shown in Appendix K.

Instructional Delivery

The computer-based training program was tried six times during the month of July, 1988. The designer chose participants who represented the target population. These participants also had to be willing to take time during lunch or breaks to go through the training.

The designer told all of the participants that this project was not sponsored or supported by Unisys. In addition, the designer told these volunteers that anything learned by their participation would be documented.

Six Unisys employees from the target population participated in the implementation of this project. This took place during the week of July 17, 1988. The instruction was delivered on the personal computer in each participant's work cubicle. The designer explained the purpose of this project and gave the participant a set of the instructional materials. See Appendix L for the location of these materials. The participants were asked to report their scores on the pretest and embedded test and the amount of time the lesson took. In addition, they were asked to complete and return the post learning questionnaire along with the instructional materials. Since the computer-based training program kept track of the scores, the participants only had to note their final score or make a printout of the screen where it was displayed.

The average amount of time each session lasted was approximately ten and six tenths minutes. The designer noted the comments expressed by the learner after each session. Judging by these comments and the results of the post learning questionnaire, the learners found the lesson necessary and helpful. All of the participants commented that they had learned something from the lesson.

Data Collection

The data that was collected during each trial consisted of the scores from the pretest and embedded tests, and the responses from the post learning questionnaire. The amount of time each trial took was only measured during the small group and field trials. This was not done during the one-on-one trials since reading and thinking out loud was done which altered the actual amount of time the instruction took. Data was also collected in the form of comments, criticisms and problems encountered during the instructional delivery. This data was collected verbally and by observation. The scoring of the tests was done electronically within the instructional program. The post learning questionnaires were filled in by each participant.

Summary

The designer delivered the computer-based training program as planned. Fifteen Unisys employees participated in the trials. Four employees participated in the one-on-one trials and five in the small group trials. Six employees participated in the implementation of this project. The designer collected data during each training session. The data consisted of the time spent during instruction, the scores of the tests, the results of the post learning questionnaire, and other observed or stated problems, comments or criticisms of the program.

CHAPTER 6

Evaluation

Introduction

The designer performed several evaluations in order to revise and perfect the instructional materials, and also to see the effect training had on the target population. Two types of evaluation were conducted: formative evaluation and summative evaluation. The first was done to determine what changes needed to be made to the computer-based training program. The latter was done to determine the actual effectiveness of this project. The formative evaluation consisted of three phases and the summative evaluation consisted of four levels.

Formative Evaluation

In the formative evaluation, the designer set out to collect data in order to revise the computer-based training program. The formative evaluation consists of three phases. They are the one-on-one trials, the small group trials, and the field trials.

One-on-one Trials

In the one-on-one trials, the designer chose four people who were representative of the target population. These trials took place during the week of July 2, 1988. The instruction was either delivered on the personal computer in the participant's work cubicle, or on the personal computer in the designer's cubicle. Each of these four Unisys employees were given the instructional program. The designer asked the participant to think and read out loud during the instruction. The designer noted scores from the pretest and embedded tests and any difficulty or comments that the learner expressed during the lesson. The learner also filled out the post learning questionnaire. After each one-on-one trial, the designer made changes to the computer-based program.

A typical one-on-one trial consisted of the following activities. The designer contacted the Unisys employee, explained this project and asked if participation was possible. If the employee was willing, the designer set up a convenient time for the training. The designer then arranged to meet either at the participant's work cubicle or the designer's cubicle. This was dependent on whether or not the participant had access to a properly configured personal computer. At the approved meeting time and place, the designer presented the learner with the instructional materials. The designer noted the start time and instruction commenced. If the participant expressed difficulty understanding the lesson or instructions, the designer noted where in the lesson this occurred and the problem expressed. Opinions, comments and criticisms were also reported. After the participant completed the post learning questionnaire, the designer noted the end time. On the average, each one-on-one trial lasted one hour. The actual time that the instruction took was not noted since reading and thinking out loud threw off this measure.

Four Unisys employees from the target audience participated in the one-on-one evaluations. The criteria for passing the pretest was that the user did not get more than two wrong out of eight questions. The criteria for passing the embedded tests was that the user did not get more than three wrong out of fifteen. Out of the four who participated, one passed the pretest and the other three failed. Consequently, those who did not pass the pretest, continued through the lesson and were tested as they went through it.

The lesson was modified after each one-on-one evaluation. The first participant commented on those questions that required the trainee to depress a letter key for the answer (the parts of the PC quiz, the true/false quiz, and the what to clean quiz). The participant suggested that the letter that was pressed should appear on the screen. Originally, after the key was pressed, feedback would appear immediately. The letter pressed would not appear on the screen. This change was made.

The second participant commented on those same questions. The suggestion was that if a letter was pressed that was not one of the choices, a message should be displayed. The message should state that the trainee had not pressed one of the choices and should try again. This change was made.

The third learner remarked that on the fill in the blank type questions, the learner's answers would be clearer if they were a different color from the question. This change was made.

See Table 3 for the scores of the four participants.

Small Group Trials

In the small group trials, the designer chose five employees from the target population to participate. These trials took place during the week of July 10, 1988. The location was the same as for the previous trials. The learners went through the revised program

Table 3

One-on-one Trial Results

Participant	Pretest	Embedded Tests
1	7/8	--
2	5/8	15/15
3	4/8	13/15
4	2/8	13/15

The average score on the pretest was 4.5.
The average score on the embedded tests was 13.7.

and the designer observed but did not talk. This was done so that the effectiveness of the changes made to the program after the one-on-one trials could be observed. The designer noted the scores from the pretest and embedded tests and the time that it took each participant to complete the lesson. In addition, comments made after the completion of the lesson were noted. Post learning questionnaires were also administered. The designer made modifications to the computer-based program according to the results and comments from the small group trials.

For the five Unisys employees from the target audience who participated in the small group trials, the criteria was kept the same as for the one-on-one trials. A score of at least six out of eight was required to pass the pretest. A score of at least twelve out of fifteen was required to pass the embedded tests. Of the five employees who participated, one passed the pretest and the other four failed. Consequently, those four continued through the lesson. All four who failed the pretest, passed the embedded tests. See Table 4 for the results of the small group trials.

Table 4

Small Group Trial Results

Participant	Pretest	Embedded	Time
1	7/8	--	4
2	6/8	14/15	12
3	5/8	15/15	13
4	6/8	14/15	11
5	3/8	14/15	15

The average score on the pretest was 5.4.
The average score on the embedded tests was 14.25.
The average time spent was 11 minutes.

The lesson was modified after it was noticed that all five participated had difficulty understanding the first two pretest questions. All five participants gave incorrect responses to the first question of the pretest. Two participants also gave incorrect responses to the second pretest question. See Figure 1 and Figure 2 for the first two questions of the pretest.

Figure 1

On the screen a graphic representation of the system unit and disk drives was displayed. The first question asked the participant to complete the statement:

<---- These are the ________________ .

The arrow pointed to the graphic representation of the disk drives.

Figure 2

The second pretest question asked the participant to complete the statement:

/\
\______ This is called the ______________________ .

The arrow pointed to the graphic representation of the system unit.

It was observed that after receiving the incorrect answer feedback from the first question, three of the five were then able to correctly answer the next pretest question.

After the small group trials, the pretest was modified to preface the first question with the following statement shown in Figure 3:

Figure 3

Name the part of the PC that the arrow is pointing to.

Field Trials

In the field trials, the designer chose six employees from the target population. These trials took place during the week of July 17, 1988. The designer gave the learners the instructional program but did not participate or watch. The purpose of this trial was to see if the instructional materials were ready to be fully implemented. The data collected was the scores from the tests, the time that it took each participant, and the post learning questionnaires.

For the six Unisys employees from the target audience who participated in the field trials, the criteria were kept the same as for the one-on-one trials and the small group trials. A score of at least six out of eight was required to pass the pretest. A score of at least twelve out of fifteen was required to pass the embedded tests. Of the six employees who participated, two passed the pretest and the other four failed. Consequently, those four continued through the lesson. All four who failed the pretest, passed the embedded tests.

After the field trials were conducted, it was determined that no more modifications to the lesson were needed since no other difficulties with the instruction were encountered. The designer presumes that the previous changes made during the one-on-one trials and small group trials cleared up any problems that the participants might have had based on clarity rather than instructional content. See Table 5 for the results of the field trials.

Compared to the average scores after the small group trials (based on the average score of five participants), the scores after the field trials were better on the pretest and time. This could be attributed to the fact that two of the questions on the pretest were modified so that the scores improved. Because of this increased clarity, the time factor also improved.

Table 5

Field Trial Results

Participant	Pretest	Embedded	Time
1	7/8	--	4
2	8/8	--	5
3	4/8	13/15	16
4	6/8	14/15	11
5	6/8	15/15	13
6	3/8	12/15	15

The average score on the pretest was 5.7.

The average score on the embedded tests was 13.5.

The average time spent was 10.7 minutes.

Summative Evaluation

The summative evaluation was based on Kirkpatrick's (1987) four levels of evaluation. All of the participants were from the target group of Unisys employees. Four people participated in the one-on-one trials, five in the small group trials and six participated in the field trials. The results were described in the formative evaluations for each trial. The four levels of summative evaluation are reaction, learning, behavior and results/impact.

Reaction

Reaction to the lesson was obtained by observation, discussion and the post learning questionnaires. In general, most of the participants agreed that the lesson was interesting and the material was easy to understand. It was observed that the participants in the one-on-one trials and small group trials had difficulty understanding some of the instructions. Modifications were made to the lesson after each trial. The participants in the field trials did not have this difficulty. Most of the participants agreed that this lesson was useful and should be used on the job. They also agreed that most PC problems were due to poor maintenance and that the implementation of this lesson in the workplace would decrease the amount of PC repairs needed.

The designer based the post learning questionnaire on Kirkpatrick's criteria. The following criteria was included when making up the questionnaire:

1. Determine the learner's reaction to the instruction.
2. Use a written questionnaire.

3. Present it at the conclusion of the lesson.
4. Design it so that it can be easily and quickly completed.
5. Design it so that the answers can be tabulated.
6. Do not require the learner's name on it.

See Table 6 for the results of the post learning questionnaires for all of the trials. See Appendix M for the results of the post learning questionnaire for each trial and for the ten questions.

Table 6

Results from Post Learning Questionnaire

Number of reponses to each question (N=15)

Question	Strongly Agree	Agree	Disagree	Strongly Disagree
1	3	10	2	--
2	8	6	1	--
3	5	8	2	--
4	6	8	1	--
5	5	7	3	--
6	2	13	--	--
7	6	8	1	--
8	3	7	5	--
9	8	6	1	--
10	6	9	--	--

Learning

Learning was measured by comparing the score of the pretest and the score of the embedded tests. Of the fifteen employees who participated in the various trials, four passed the pretest and eleven failed. Therefore, those four did not continue through the lesson. Of the eleven who failed the pretest, all passed the embedded tests. Through these measurements, it was determined that learning did occur. See Table 7 for the scores from all of the trials.

Table 7

Results from All Trials

Participant	Pretest	Embedded Tests
1	7/8	--
2	5/8	15/15
3	4/8	13/15
4	2/8	13/15
5	7/8	--
6	6/8	14/15
7	5/8	15/15
8	6/8	14/15
9	3/8	14/15
10	7/8	--
11	8/8	--
12	4/8	13/15
13	6/8	14/15
14	6/8	15/15
15	3/8	12/15

Behavior

No surveys or tests were done to measure behavior. It has, however, been informally observed by the designer that those employees who participated in the trials practice better PC maintenance. Those employees who used to eat and drink coffee while working on the PC do not anymore. It has also been observed that those employees who had little or no previous PC experience started using the PC and following correct maintenance procedures shortly after participating in the trials. Thus, behavior has been affected. Ideally, after training, the behavior of all participants could be affected as follows:

1. Each participant would keep the personal computer away from heat sources in the work place and not store papers or books on any component.

2. The various parts of the personal computer would be cleaned on a regular basis to be determined by how often it was used.

3. If that component was dirty or had been spilled upon, the employee would clean that part immediately.

4. If the personal computer or any part of it needed to be moved, the learner would follow the proper procedures for moving it.

5. Surge protectors would be used on every personal computer in the Unisys plant.

6. No employee would eat, drink, or smoke near the equipment.

Results/Impact

No results/impact have been measured. It is proposed that if full implementation of this lesson were to take place, Unisys would conduct a study involving the number of PC repairs reported and the reason for repair. This study would involve both the groups which went through the lesson and test groups which did not. This way, the results/impact could be measured. Based on these observations, the designer believes that a great savings could be realized by implementing this project. See Table 8 for projected savings versus costs of the instructional solution. This table is based on assumptions and projections made by the designer. Costs have been estimated based on observed costs at Unisys. Savings and costs will differ at other locations and times.

Table 8

Projected Savings vs. Costs

Project cost (see Table 1)	$4,815
hours of instruction	0.5
people to be trained	4000
total hours training	2000
hourly cost per person	$20
hourly cost per PC	$1
total cost of participation	$42,000
Grand Total cost of training	$46,815

Assume that:	cost	# people	lost
every third person ruins a disk;	$2	1333	$2,667
of those, every 3rd didn't back up (10 hrs. lost time @ $20/hr.)	$200	444	$88,889
every 20th person damages equipment ($300 damage + 2 hours lost at $20/hr.)	$340	200	$68,000
total damage done in one year			$159,556
minus total cost of training			$46,815
amount saved in first year ---------------------------->			$112,741
total damage done every year thereafter			$159,556
assuming only every fourth person needs retraining			$10,500
the amount saved in each year thereafter ------------------>			$149,056

Learning Transfer

According to Broad (1988), learning transfer to the job is best achieved through the participation of the organization, including upper management and the trainee's supervisor, the trainer and the trainee. Support should be given before, during and after training. In order to ensure the transfer of training to the job, it is recommended that certain steps be taken.

As recommended by Broad, each manager or supervisor of a potential trainee should participate in training. This should be done so the supervisor can understand the importance of the training and thus fully support the trainee. In addition, training should be required and supported for all employees who work with or near computer equipment. Trainees and supervisors should get baseline performance data (PC repair/failure reports) before training so results can be measured. Potential trainees must be allowed time to participate in training without interruptions. Records of successful completion of training should be kept in each employee's folder. Supervisors should allow trainees to participate in work-related decisions regarding PC maintenance schedules in their area. A trained employee in each section should be assigned to be the PC maintenance coordinator responsible for helping new trainees, until everyone has been trained. Each department should track post training performance data and compare to baseline data. Employees should receive an incentive for better than average improvement. Supervisors should arrange further training or investigation if little or no significant improvement has been made. Finally, management must make the commitment to training and update training as equipment changes or requirements change.

Summary

The designer conducted both formative and summative evaluations. After each of the one-on-one trials and after the completion of the small group trials, the designer made changes to the computer-based program based on the results of these trials. After the field trials, it was determined that no more modifications would be needed. Four participants passed the pretest and did not choose to continue with the lesson. Of the eleven employees who failed the pretest, all eleven went on to pass the embedded tests. Based on the post learning questionnaire and observation, the result of the training was positive. Learning did occur as proven by the test scores. It has been noticed since the conclusion of the trials that behavior has been affected in a positive direction as a result of training. The results/impact of training has been projected based on costs. The designer has suggested ways to effectively transfer the learning to the job. The materials in this project appear to be reliable and valid and this project appears to be effective.

CHAPTER 7

SUMMARY AND RECOMMENDATIONS

Introduction

In this final chapter, the designer summarizes the contents and phases of this project. She concludes this document with recommendations and suggestions for anyone who may wish to continue this project in any way or adapt it to their own uses. In addition, she offers encouragement to other students who are doing projects, computer-based or not, of their own.

Methods and Procedures Used

The method used in developing this computer-based training program was based on the Instructional Systems Implementation (ISD) model. This model is comprised of the following five phases: analysis, design, development, implementation and evaluation. They are each described and summarized below.

Analysis

The designer analyzed the training needs based on observation and her experience with the organization. In addition, she researched literature on the topics of computer-based training and personal computer maintenance and found that information on the combination of topics was lacking, although vendor information existed. The instructional goal and media were defined. The target population and organizational constraints were identified and a project plan and budget were prepared. The project schedule went according to plan. The development of the project started in

February 1988 and ended in September 1988.

Design

The designer conducted an instructional task analysis and identified the instructional objectives and entry behaviors. The plan was for the development of a self-paced computer-based training program which would include a pretest and embedded tests. A post test was not included since this would result in redundancies in questions. A learning transfer system was designed. The designer reviewed and did not select any existing materials for inclusion in this project. It was determined that the evaluation system used would include both formative and summative techniques.

Development

The designer developed the instructional materials using the method typically used by programmers, top-down design. Programmer ready materials were produced before coding commenced. A flow chart diagram was omitted. Gagne's nine events of instruction were used to develop the instructional events. The materials were reviewed by a CAI expert and an English expert. The effectiveness and accuracy of the instructional materials were confirmed. The English expert confirmed that the grammar, punctuation and style were correct. Three sets of the computer-based program and delivery program were produced. Fifteen sets of the attitude questionnaire were produced; one for each training session.

Implementation

Field trials were conducted during the week of July 17, 1988. Six Unisys employees participated. The designer collected data during each training session. The data consisted of the time spent during instruction, the scores of the tests, the results of the post learning questionnaire, and other observed or stated problems, comments or criticisms of the program. All of the participants passed either the pretest or the embedded tests.

Evaluation

The designer conducted both formative and summative evaluations. Fifteen Unisys employees from the target population participated in the trials. Four participated in the one-on-one trials, five in the small group trials and six in the field trials. After each of the one-on-one trials and after the completion of the small group trials, the designer made changes to the computer-based program based on the results of these trials. After the field trials, it was determined that no more modifications would be needed. Based on the post learning questionnaire and observation, there was a positive result to the training. Learning did occur as indicated by the test scores. It was noticed since the conclusion of the trials that behavior had been affected in a positive direction as a result of training. The results/impact of training was projected based on costs. The designer suggested ways to effectively transfer the learning to the job.

Conclusions

The target population of this project includes Unisys employees with a wide range of knowledge about personal computers. Since this project was computer-based, learners were able to proceed throughout the lesson at their own pace.

Behavior was informally observed at the conclusion of this project and was found to have been altered. Unisys employees who participated in this project were seen to practice the personal computer maintenance procedures that were presented in the computer-based training program.

It appears that this computer-based training program for beginner personal computer maintenance is appropriate for Unisys employees who work on or near such equipment. The results of this project demonstrated to the designer that there is a definite need for such training at Unisys and that this computer-based training program can eliminate this need.

Recommendations

1. If the designer was able to continue with this project, she would complete the following three lessons which were described in the design document: Proper diskette care/handling/storage; Software backups; and Electro-static discharge (ESD) prevention. This would enable the computer-based training program to address the training needs of all aspects of personal computer maintenance. This would include both hardware and software maintenance and be suitable for both the beginner and the more advanced user.

2. The use of graphics would be extended to promote learning. Better and more extensive images would made for clearer understanding of the subject matter and would hold the learner's attention more. In addition, better graphics than those used would serve to help the learner's retain the information presented. This designer used only those graphics which were included in the student version of the Unison Authoring Language package. Better

graphics packages are available at an additional cost.

3. If someone from a company other than Unisys wished to use this computer-based training program, it is recommended that they make sure that all terminology and graphic representations of equipment presented in this program match those used in their company.

4. It is recommended that if anyone wants to use the Unison Authoring Language, that the full version be used and not the Student version. This designer used the student version and reached the allowable limits of space and units. In addition, she had to use inferior graphics than what she had hoped to use in this computer-based training program. Also, the student version can not be used for production use.

5. This designer would do the following to ensure the transfer of training to the job:

1. call the supervisors of the trained employees to see if maintenance procedures were being followed
2. send information and samples from the manufacturer's of maintenance products to trained employees
3. contact the trainees personally to see if they are applying what they learned or are having difficulty doing so
4. organize with management an incentive award for the sections or departments with the largest reduction in dollars lost due to poor maintenance

Concluding Statement

This designer has learned a great deal by developing this project and writing this document, the least of which is how to manage her time more efficiently. Many vendors, computer stores and companies offer training relating to personal computer use. Almost all offer courses on the use of various software packages. This designer has done extensive research and found no courses, computer-based or not, on the topic of personal computer maintenance for the beginner. She believes that such a course, in whatever format, is essential in places where people work on or near personal computers. Unisys needs such a course. To control cost and time, for this project, the best media is computer-based training. This designer has received encouragement from various vendors and almost all of the participants. She has not yet decided if she will, on her own, develop the remaining lessons and market them.

This designer hopes that anyone wishing to use this project to learn about the topic of personal computer maintenance, feel free to do so. In addition, it is the wish of this designer that any other student who is writing a thesis, or will be soon, use this document as a reference or guide. This designer consulted past student's theses and was inspired. As encouragement to those who may, in the future, be responsible for a training project: if a math/computer major can write a document like this, so can you!

APPENDIX A

Companies and Vendors Contacted

ADR
Route 206 & Orchard Rd.
Princeton, NY 08540
201 874-9000

Ashton Interactive Training Corp.
P.O. Box 5619
Vestal, NY 13851
607 748-4015

Bell and Howell
7100 McCormick
Chicago, IL 60645
312 673-3300

Combase, Inc.
Suite 890 333 Sibley Street
St. Paul, MN 55101
612 221-0214

Computer Systems Research
40 Darling Drive Avon Park South
Avon, CT 06001
201 678-1212

Computer Teaching Corp.
Illini Plaza 1713 South Neil
Champaign, Il 61820
217 352-6363

Conceptual Systems, Inc.
1100 Wayne Ave. 12th floor
Silver Spring, MD 20910
301 589-1800

Daines Associates
P.O. Box 75962
St. Paul, MN 55175
612 298-1104

Hazeltine
10800 Parkridge Blvd.
Reston, VA 22091
703 620-6800

IBM
240 Research Blvd.
Rockville, MD
301 530-4440

Interactive Training System
9 Oak Park Drive
Bedford,, MA 01730
617 271-0500

Learned & Tested
P.O. Box 9960
San Antonio, TX 78204
1 800 634-0424

Learning Technologies, Inc.
13633 Gamma Road
Dallas, TX 75244
1 800 238-4277

McGraw-Hill Microcomputer Software Unit
1221 Avenue of the Americas
New York, NY 10020
212 512-6589

Raster Sciences, Inc. Training Technology Division
P.O. Box 3477
Longwood, FL 32779
305 889-8555

Read/Right Products Division (The Texwipe Company)
650 East Crescent Ave. P.O. Box 575
Upper Saddle River, NJ 07458
201 327-9100

Spectrum
18 Brown Street
Salem, MA 01970
617 741-1150

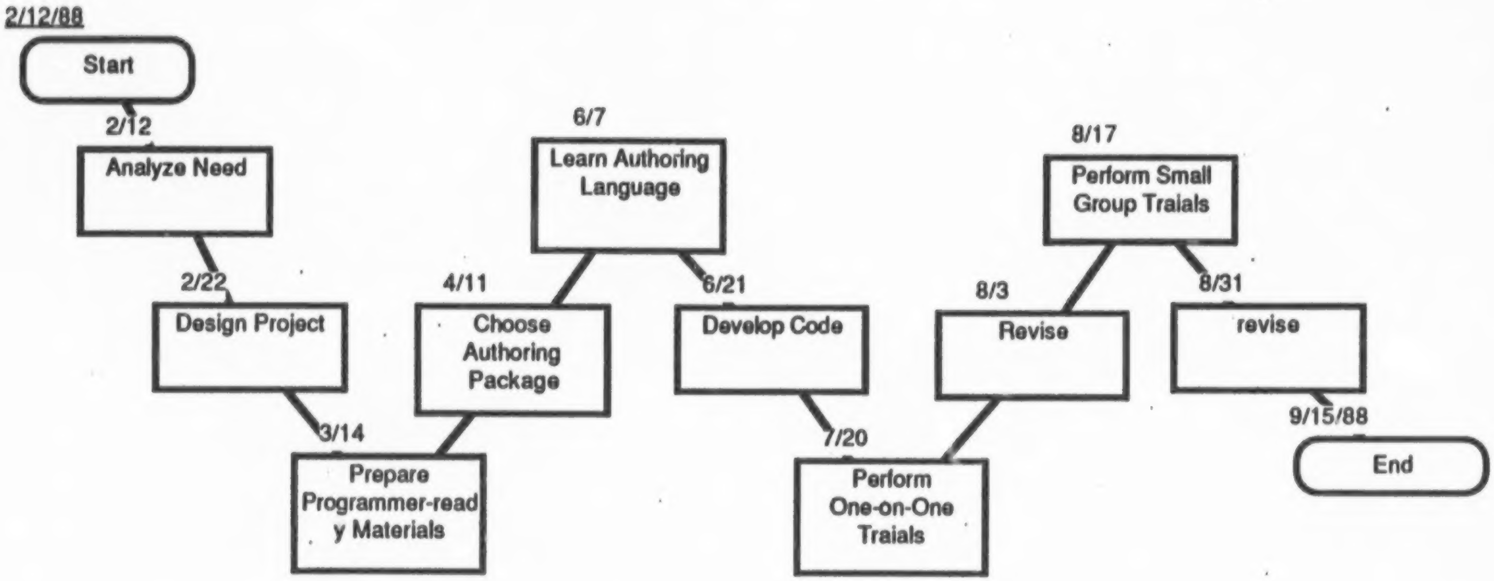
TEC Associatess (Needs Analysis & Evaluation)
68 Scenic Drive
Leominster, MA 01453
617 534-3622

Unison Courseware Applications, Inc.
475 Devonshire Drive
Champaign, IL 61820
217 359-1878

APPENDIX B

Project Plan

PC First Level Maintenance Course Development Plan



2/12/88

Start

2/12

Analyze Need

2/22

Design Project

3/14

Prepare Programmer-ready Materials

4/11

Choose Authoring Package

6/7

Learn Authoring Language

6/21

Develop Code

7/20

Perform One-on-One Traials

8/3

Revise

8/17

Perform Small Group Traials

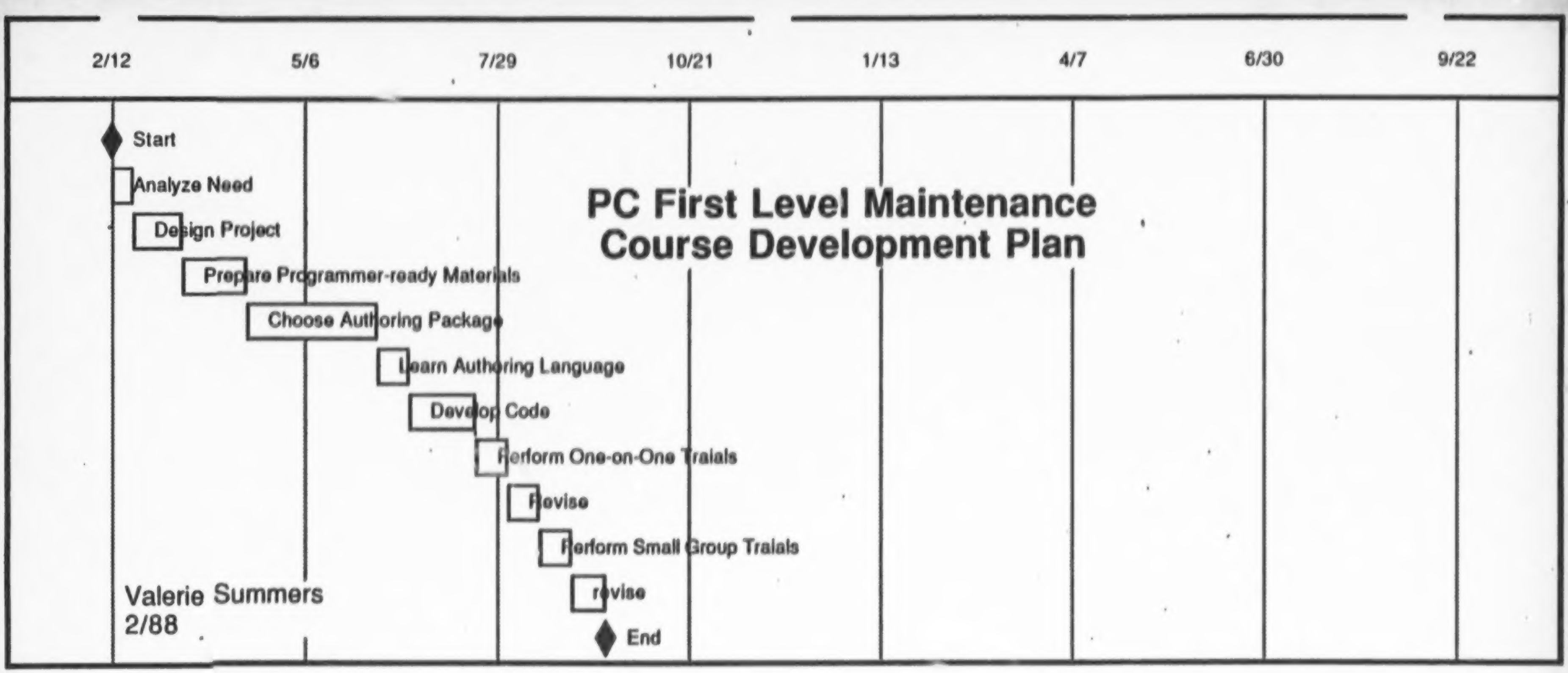
8/31

revise

9/15/88

End

Valerie Summers
2/88



PC First Level Maintenance Course Development Plan

Valerie Summers
2/88

APPENDIX C

Design Document

DESIGN DOCUMENT

prepared by Valerie B. Summers
for TLT 0661 Spring 1988

1.0 INTRODUCTION

Meetings were held on February 12 and 13, 1988 at New York Institute of Technology. Five students and the Director of the graduate Training and Learning in Technology degree met for the first time to discuss computer courseware design.

This document presents the design of a course, as well as the lessons that comprise it for what Valerie Summers will later develop into her thesis project.

Valerie Summers currently is employed at Unisys (formerly Sperry) as an associate computer engineer. She has been with the company for over three and a half years. This course will be designed as if it were to be used at a company like Unisys.

2.0 PROBLEM IDENTIFICATION

Four years ago, the Sperry Synergistics Quality Circle proposed a pilot program to automate one department using Sperry personal computers. This concept was successful and the use of PCs became commonplace.

Training and guidelines for the maintenance of the hardware and software were never formally given. Hence proper care and maintenance never became routine.

Many floppy diskettes with valuable software and data have been ruined as a result of the wide variance in maintenance stringencies. This is also true for hardware. Misuse and maintenance ignorance have cost Sperry greatly both in money and lost time.

This CBL course is being developed to test and train new as well as current employees on proper PC maintenance. All employees will have to pass a competency test in order to use equipment and software. If they fail, they will proceed through the CBL course and be retested until they pass. Hopefully, they will use what they learn and reduce hardware and software damage.

2.1 PRESENT PERFORMANCE

Due to the wide variety of factors involved, it is necessary that all employees be trained in four basic areas:

- external workstation maintenance
- care and handling of diskettes/cartridges
- software back-ups
- ESD (electro-static discharge)

2.2 DESIRED PERFORMANCE

All employees who interact with the PC should be able to properly clean their equipment externally and practice preventive maintenance. The number of damaged disks/cartridges and amount of lost data should be reduced. Also, time lost due to lost data/software should be reduced by having recent back-ups. Finally, employees should be knowledgeable about the prevention of damage due to ESD. This should reduce the number of repairs and replacements of hardware due to ESD damage.

2.3 TARGET POPULATION

The employees who will use this CBL course are those who use or work near a PC. They may be at any level of education (some high school through PhD level). They may be permanent or temporary employees of the company. They may have no knowledge or advanced knowledge of the PC.

3.0 APPROACH

Because of the diverse backgrounds of the population that will use this CBL course, the following approach will be taken:

Every new and current employee working near or with a PC will be required to pass this CBL course.

Since some employees might already feel that they know the material, they will be given the opportunity to pass a pre-test for each unit. If they do so, they will skip to the next unit until the course is complete. If the employee fails the pre-test for a unit, or decides not to take it, the material will be presented and testing will be done by questions included in each lesson.

If a significant amount of hardware/software damage occurs in a particular area, some or all employees in that area will be required to retake this CBL course to prove competency and for refreshment purposes.

The estimated time of this course will be from one half hour for more advanced employees who are familiar with PC maintenance, to one and one half hours for beginners with little or no experience.

Descriptions of this course and the lessons are contained in sections 9 and 10.

4.0 GOAL STATEMENT

All Unisys employees working near or using a personal computer (PC) will understand and practice hardware and software maintenance such that the cost both in time and money due to damage is decreased.

5.0 CONSTRAINTS

1. Equipment

The PC workstations to be used will be the Sperry PCs already in use. Configurations will vary with these possibilities:

unit type:

two floppy disk drives
one drive + hard disk
two drives + hard card
two drives + Bernoulli box

monitor type:

monochrome monitor
medium resolution monitor
high resolution monitor
enhanced graphics color monitor

2. Software

Lessons will be self-paced, utilize graphics and include pretesting and testing (exersizes) within each lesson. All inputs will be made through the keyboard.

3. Coordination

Successful completion of these tasks requires the approval and funding of Unisys management. For the development of Valerie Summers' thesis, only the approval of the director of the graduate program is required. Funding for that endeavor will be provided by the above mentioned party.

6.0 DEVELOPMENT PLAN

The following outlines the activities for the development of the PC hardware/software maintenance course.

A preliminary design document will be submitted on March 11, 1988.

Scripting and Programmer-ready materials will be submitted on April 8, 1988.

All activities for the development of this course were or will be performed by Valerie Summers using Unisys as the model.

7.0 DELIVERABLES

The deliverables for the PC hardware/software maintenance course development are:

1. Two copies of the Course Design Report
2. Two copies of the programmer-ready materials for each of the four proposed units

8.0 ROLES AND RESPONSIBILITIES

Project Manager/Design Analyst/Programmer (Valerie Summers)

- consults with NYIT graduate Director of Training and Learning
- prepares design document
- participates in reviews of all deliverables
- determines instructional goals and objectives
- collects and organizes subject matter
- develops instructional design strategy
- prepares lesson scripts and programmer-ready materials
- performs quality assurance evaluation and testing of disks and printed material
- designs the programs and writes programming specifications
- translates scripts into CBL code
- checks and corrects programming code
- downloads code to disks

Project Manager (Dr. A. Reynolds)

- performs requirements assessment
- approves project plans and schedules
- monitors schedule compliance
- participates in review of all deliverables
- coordinates meeting schedules
- signs approval and acceptance forms (presents grade)

9.0 COURSE DESCRIPTION

The PC hardware/software maintenance course will consist of approximately 1.5 hours of CBL courseware on floppy diskettes. The course emphasis will be on teaching students how to care for their equipment and prevent damage due to the environment and carelessness. A pretest will be given in each unit so that more advanced students can skip to the next unit. Within each unit will be questions to test the comprehension of those students who fail the pretest or who decided to go through the lesson.

9.1 OBJECTIVES

After completing this course, the student will be able to --

1. Name the different parts of the PC workstation
2. Use the proper cleaning/maintenance products for the exterior of the PC
3. List ways to prevent hardware damage due to improper maintenance and usage
4. Practice proper disk drive maintenance
5. Properly hold floppy diskettes/cartridges
6. Properly use floppy diskettes/cartridges
7. Properly store floppy diskettes/cartridges
8. List all methods of backing up software programs/data
9. List the DOS commands that copy files and disks
10. List ways to prevent damage to hardware due to ESD

9.2 CONTENT REFERENCES

A partial list of references for lesson content follows.

- the back jacket of a floppy diskette
- the instructions given in cartridge packets
- the DOS user's manual
- various vendor maintenance product literature

10.0 LESSON DESCRIPTIONS

Lesson descriptions follow. The length given for each lesson is an estimate only, and based on the assumption that a full screen of text and graphics takes an average of one minute to read, and one interaction that involves a calculation takes two minutes. The pretest at the beginning of each unit takes between five and ten minutes.

10.1 EXTERNAL WORKSTATION MAINTENANCE

Lesson Title: External Workstation Maintenance

Length: 30 minutes

Description:

This lesson will present a basic approach to external hardware maintenance. This lesson will cover common sense information on what not to do near the PC as well as how to clean and maintain it when not in use.

The following topics will be included:

- parts of the PC
- preventive maintenance
- external cleaning
- disk drive maintenance

Lesson Purpose:

After completing this activity, the student will have gained or reinforced an understanding of:

1. the different parts of the PC
2. how to maintain the PC when it is not in use or is being moved
3. other preventive mintenance concepts
4. proper external cleaning rules
5. proper disk drive maintenance

Instructional Objectives:

After completing this activity, the student will be able to:

1. Name the different parts of the PC workstation
2. Use the proper cleaning/maintenance products for the exterior of the PC
3. List ways to prevent hardware damage due to improper maintenance and usage
4. Practice proper disk drive maintenance

10.2 CARE AND HANDLING OF DISKETTES/CARTRIDGES

Lesson Title: Care and Handling of Diskettes/Cartridges

Length: 30 minutes

Description:

This lesson will present the proper way to handle, use and store floppy diskettes and cartridges.

The following topics will be included:

- handling of floppy diskettes/cartridges
- usage of floppy diskettes/cartridges
- storage of floppy diskettes/cartridges

Lesson Purpose:

After completing this activity, the student will have gained or reinforced an understanding of:

1. the proper way to handle floppy diskettes/cartridges
2. the proper way to use (load) floppy diskettes/cartridges
3. the proper way to store floppy diskettes/cartridges

Instructional Objectives:

After completing this activity, the student will be able to:

5. Properly hold floppy diskettes/cartridges
6. Properly use floppy diskettes/cartridges
7. Properly store floppy diskettes/cartridges

10.3 SOFTWARE BACK-UPS

Lesson Title: Software Back-ups

Length: 15 minutes

Description:

This lesson will present the various ways to back-up software programs/data. It will discuss the process of backing up hard disks, hard cards and cartridges. This lesson will also cover the methods of backing up individual files and floppy diskettes by using common DOS commands. This lesson will also remind the student of the importance of frequent back-ups.

The following topics will be included:

- software backup methods for hard disks, hard cards and cartridges
- software back-ups for files and floppy diskettes using DOS commands

Lesson Purpose:

After completing this activity, the student will have gained or reinforced an understanding of:

1. the various methods of backing up hard disks, hard cards and cartridges
2. the DOS commands used for backing up individual files and floppy diskettes

Instructional Objectives:

After completing this activity, the student will be able to:

8. List all methods of backing up software programs/data
9. List the DOS commands that copy files and disks

10.4 ESD (ELECTRO-STATIC DISCHARGE)

Lesson Title: ESD (Electro-Static Discharge)

Length: 15 minutes

Description:

This lesson will define what ESD is and what damage can ensue if it occurs. This lesson will also present the preventive measures that should be taken to prevent damage due to ESD while handling static sensitive items associated with the PC.

The following topics will be included:

- definition of ESD (electo-static discharge)
- steps to prevent ESD damage

Lesson Purpose:

After completing this activity, the student will have gained or reinforced an understanding of:

1. ESD (electro-static discharge)
2. the steps necessary to prevent ESD from damaging the PC

Instructional Objectives:

After completing this activity, the student will be able to:

10. List ways to prevent damage to hardware due to ESD

APPENDIX D

Pretest Questions

Pretest Questions

```
|-------------|
|             |
|        [==] |   <----- These are the ________________.
|        [==] |
|-------------|
   /\
    \_______ This is called the ___________________.
```

NAME THE PART OF THE PC THAT THE ARROW IS POINTING TO.

When moving the PC a short distance, if it has a hard drive, you should park the _____________.

If you clean your monitor screen, use a cloth that is _________ - free to clean off dust and dirt.

Use a ___________ protector to guard against power fluctuations during electrical storms.

Don't smoke or drink or _______ near the PC.

If an accidental spillage on a part occurs, then you should ____________ that part immediately!

So that the rubber parts of the printer don't dry up, use _____________ - free cleaning solution.

APPENDIX E

Embedded Test Questions

Embedded Test Questions

```
                          <---
                                          TYPE A LETTER (a thru e)
  |                                       OF THE PART WHERE THE
  `--->                      <--,         ARROW IS AND THEN HIT
                                |         THE RETURN KEY:

                                            a. PRINTER
                                            b. SYSTEM UNIT/CPU
                                            c. MONITOR
                                            d. KEYBOARD
                                            e. DISKDRIVES
                               <---

                     <------
```

Answer each question as TRUE or FALSE by typing a T or F next to each statement. Use lower case letters (t or f).

It is a good idea to keep the PC covered when it is not in use. (t or f)?

Keep floppy disks in the disk drives at all times; even when the PC is not in use. (t or f)?

When moving the PC a short distance, all loose parts should be secured or tied down. (t or f)?

When moving the PC a long distance, it should be carefully packed in original boxes if possible and packed according to packing instructions. (t or f)?

MATCH THE PROBLEM WITH THE CORRECT SOLUTION:

PROBLEM	SOLUTION
1. Soda spilled on keyboard and keys stick.	a. Clean monitor with a lint free cloth and special cleaning fluid.
2. It's hard to read the words on the computer screen because of fingerprints.	b. Clean disk drive with special cleaning kit.
3. Computer is missing data on disk and giving me "read" errors.	c. Clean keys of keyboard with special cleaning fluid applied to swabs.

FILL IN THE LETTER OF THE SOLUTION THAT GOES WITH THE PROBLEM.

1. 2. 3.

Just to make sure that you know your stuff:

DO use a ______________ protector to guard against power surges!

DO keep the PC away from ________ sources such as direct sunlight, steam vents and radiators.

DO _____________ any part of the PC that starts to malfunction or has had a beverage accidentally spilled on it.

APPENDIX F

Programmer Ready Materials

LESSON: ~~[illegible]~~ INTRO
UNIT: mainmenu

☐ NEXT
☐ BACK
☐ NEXT1
☐ DATA
☐ HELP
☐ BACK1
☐ LAB
☐ STOP

MAIN MENU

Welcome to the world of PC's. To learn ~~more~~ about maintenance, type the letter associated with each lesson:

H - Hardware maintenance

F - Floppy Diskette/cartridge care.

S - Software maintenance

E - ESD (Electro-static Discharge)

Q - quit this program.

H hardintr
F flopintr
S softintr
E ESDintr
Q quit

LESSON: Hardware
UNIT: hardintr

☐ **NEXT** ______
☐ **BACK** ______
☐ **NEXT1** ______
☐ **DATA** ______
☐ **HELP** ______
☐ **BACK1** ______
☐ **LAB** ______
☐ **STOP** ______

HARDWARE MAINTENANCE

TYPE THE LETTER corresponding to the action you want to perform:

P - Take the pre-test and skip this lesson if you pass.

L - go through this lesson and be tested as you go through it

m - Return to the main menu.

→

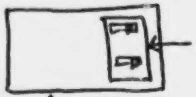
P pretest 1

L partintr

m mainmenu

LESSON: Hardware
UNIT: pretest.1

☐ **NEXT1** ________
☐ **BACK1** ________
☐ **NEXT** ________
☐ **DATA** ________
☐ **LAB** ________
☐ **BACK** ________
☐ **HELP** ________
☐ **STOP** ________



These are the ______ - ______

This is called the ______ (hint: 3 letters)

When moving the PC a short distance, if it has a hard disk, you should park the ______.

If you clean your monitor screen. Use a cloth that is ____ - ____ to clean off dust and dirt.

Use a ______ protector to guard against power fluctuations during electrical storms.

(return) for next question

(spacebar) for next screen

for each correct answer, increment rightanswer counter.

for each wrong answer, increment wronganswer counter.

Display each question, wait for answer and <return> then evaluate and display next question under it.

When done with screen, display message to go to next page

<spacebar> pretect2

correct answers:

disk-drives
cpu
heads or disk
lint-free or static free
surge

Dont ____ or drink or smoke near the PC.

If an accidental spillage on a part occurs, ____ that part immediately.

Use ____-free cleaning solution on the printer so the rubber doesn't dry up.

<spacebar> for next screen

LESSON: hardware
UNIT: pretest 2

☐ **NEXT** ____
☐ **DATA** ____
☐ **LAB** ____
☐ **BACK** ____
☐ **HELP** ____
☐ **STOP** ____
☐ **NEXT1** ____
☐ **BACK1** ____

Same instructions as previous page.

When done displaying questions, see if correct. If all correct pregood 1

If not all correct prebad 1

<spacebar> pregood 1 OR prebad 1

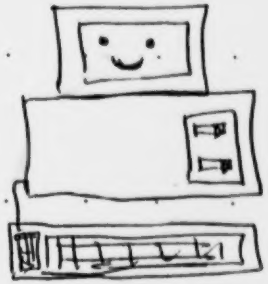
Correct answers:

eat
clean
alcohal

GREAT! You passed the pretest.

press the <spacebar> to go to the printing screen.

Then you can go on to other sections.



<spacebar> for next screen.

LESSON: hardware
UNIT: hwgood1

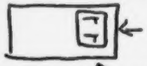
☐ **NEXT1** ________
☐ **BACK1** ________

☐ **NEXT** ________
☐ **DATA** ________
☐ **LAB** ________

☐ **BACK** ________
☐ **HELP** ________
☐ **STOP** ________

<spacebar> hwdprint

SORRY - you missed some! Here are the correct answers. Go through the tutorial and you will be quized as you go along.



← These are the disk-drives.

↑ This is called the CPU.

When moving the PC a short distance, if it has a hard disk, you should, park the heads or disk

If you clean your monitor-screen. Use a cloth that is lint-free to clean off dust and dirt.
static-free

Use a surge protector to guard against power fluctuations during electrical storms.

Don't eat or drink or smoke near the PC.

If an accidental spillage on a part occurs, clean that part immediately.

Use alcohol-free cleaning solution on the printer, so the rubber doesn't dry up.

<spacebar> to see next screen.

LESSON: hardware
UNIT: pcbad1

☐ NEXT1
☐ BACK1
☐ NEXT
☐ DATA
☐ LAB
☐ BACK
☐ HELP
☐ STOP

<spacebar> partintr

LESSON: Hardware
UNIT: Partintr

☐ NEXT1
☐ BACK1
☐ NEXT
☐ DATA
☐ LAB
☐ BACK
☐ HELP
☐ STOP

spacebar partgrh
escape mainmenu

What you are working on now is a PC. That stands for Personal Computer. It consists of different parts. Some are used for inputing and some are output devices.

Press the spacebar to see each part of the computer and a description of what it does.

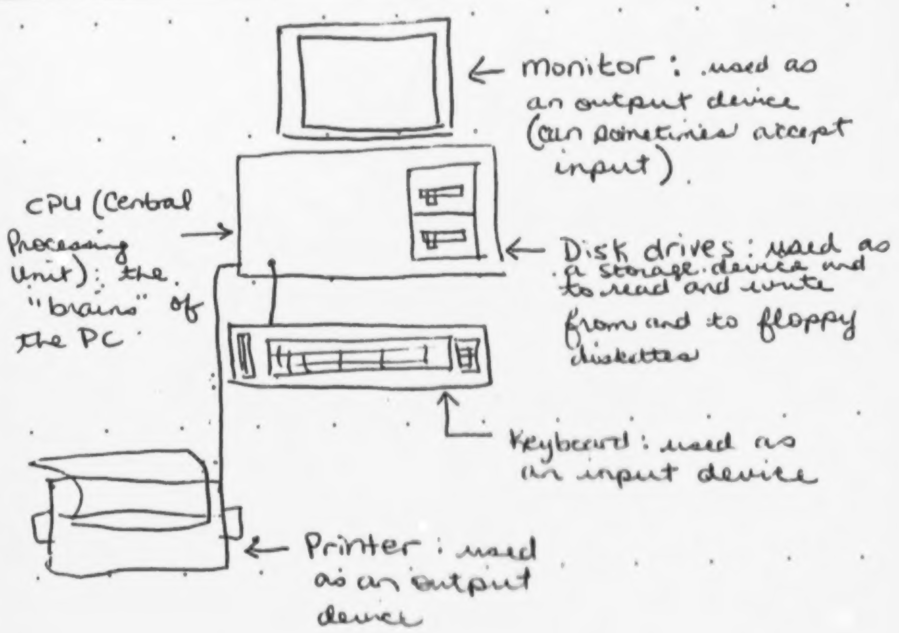
<spacebar> to see next screen
<escape> to return to Main menu

LESSON: Hardware
UNIT: Partgrph

☐ NEXT1 ______
☐ BACK1 ______

☐ NEXT ______
☐ DATA ______
☐ LAB ______

☐ BACK ______
☐ HELP ______
☐ STOP ______


← monitor : used as an output device (can sometimes accept input)
CPU (Central Processing Unit): the "brains" of the PC →
← Disk drives : used as a storage device and to read and write from and to floppy diskettes
Keyboard : used as an input device
← Printer : used as an output device

Press <spacebar> to see (next screen) each part ~~<Return>~~
<escape> to return to main menu
<F1> to go back a screen

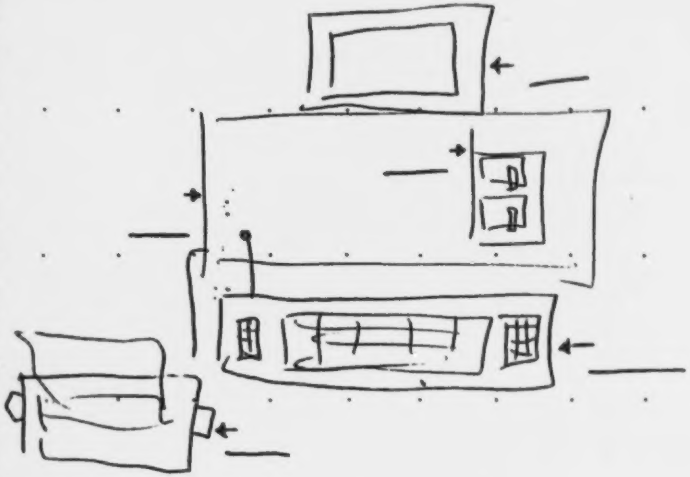
allow <spacebar> to advance to next part until done, then change message at bottom to say ... next screen ...

<escape> mainmenu

<F1> partints

<spacebar> partquiz

Match each part of the PC with its name by typing the ~~letter~~ number next to each part: Press <return> after each answer.



1. Keyboard
2. printer
3. CPU
4. monitor
5. disk drives

<spacebar> to go to next screen
<escape> to return to main menu
<F1> to go back a screen

LESSON: Hardware
UNIT: partquiz

☐ **NEXT**
☐ **BACK**
☐ **NEXT1**
☐ **DATA**
☐ **HELP**
☐ **BACK1**
☐ **LAB**
☐ **STOP**

correct answers (from top to bottom):
4, 5, 3, 1, 2

partok

if not correct than

partbad

after each answer, <return> and evaluate

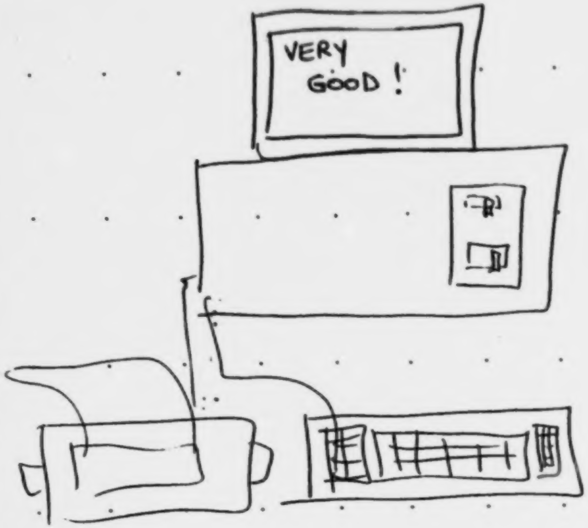
<escape> mainmenu

<F1> partgraph

LESSON: Hardware
UNIT: partote

☐ **NEXT1** ______
☐ **BACK1** ______
☐ **NEXT** ______
☐ **DATA** ______
☐ **LAB** ______
☐ **BACK** ______
☐ **HELP** ______
☐ **STOP** ______

<spacebar> notinuse
<escape> mainmenu



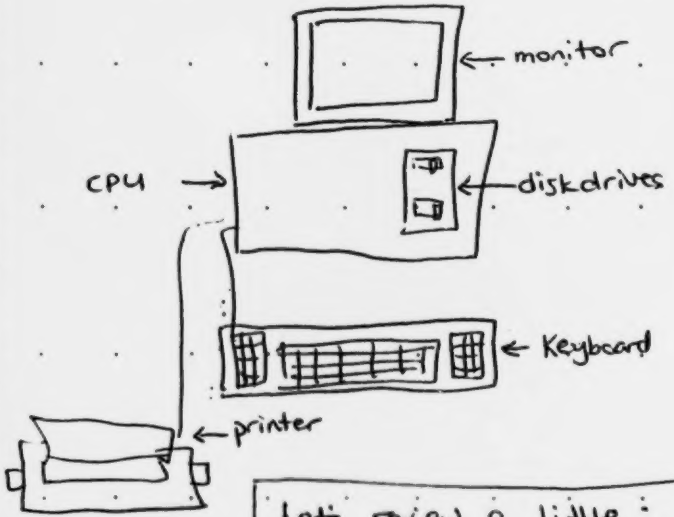
VERY GOOD ! YOU REALLY KNOW THE NAMES OF THE PARTS OF THE PC WELL !

<SPACEBAR> to see next screen.
<escape> to return to main menu

LESSON: Hardware
UNIT: partbad

☐ NEXT
☐ BACK
☐ NEXT1
☐ DATA
☐ HELP
☐ BACK1
☐ LAB
☐ STOP

<spacebar> not in use
<escape> mainmenu


monitor
CPU
diskdrives
Keyboard
printer

Let's review a little:
The correct answers are shown above.

<spacebar> to see next screen
<escape> to return to main menu

When the PC is not in use, it is a good idea to cover it so that it is protected from dust or accidents. Specially made covers are sold for this purpose.

Don't put piles of papers on ~~top~~ of any of the parts of the PC. It is not a piece of furniture!

Don't keep floppy disks in the disk drives – they should be stored properly. (More on that in a later lesson)

<spacebar> for more
(next screen)
<escape> to return to main menu

LESSON: Hardware
UNIT: notinuse

☐ NEXT1 ______ ☐ NEXT ______ ☐ BACK ______
☐ BACK1 ______ ☐ DATA ______ ☐ HELP ______
☐ LAB ______ ☐ STOP ______

<spacebar> to see each paragraph
When done change message on bottom to say – – next screen
then:

<spacebar> moving
<escape> mainmenu

LESSON: hardware
UNIT: moving

☐ **NEXT1** ☐ **NEXT** ☐ **BACK**
☐ **BACK1** ☐ **DATA** ☐ **HELP**
☐ **LAB** ☐ **STOP**

When moving the PC a short distance, it is a good idea to:

- make sure it is turned off
- secure any loose parts
- cover or wrap any delicate parts
- park hard disk drive heads (refer to user's manual)
- place a blank diskette or special cardboard in disk drives and close doors.

If moving the PC a long distance, do all of the above and also:

- wrap all parts in original packing material and boxes.
- follow manufacturer's instructions for packing

<spacebar> for more (next screen)
<escape> to return to main menu
<F1> to go back a screen

<spacebar> to see each paragraph
when done change message on bottom to say - - - next screen
then:

<spacebar> usequing
<escape> mainmenu
<F1> notinuse

Answer each question as TRUE or FALSE by typing a T or F next to each statement.

___ It is good to keep the PC covered when not in use.

___ Keep floppy disks in the drives all the time.

___ When moving the PC a short distance, all loose parts should be secured.

___ When moving the PC a long distance, it should be carefully packed in original boxes if possible and according to packing instructions.

<spacebar> for next screen
<escape> to return to main menu.

LESSON: hardware
UNIT: usequiz

☐ NEXT1 ________
☐ BACK1 ________
☐ NEXT ________
☐ DATA ________
☐ LAB ________
☐ BACK ________
☐ HELP ________
☐ STOP ________

Correct answers:
T, F, T, T

increment right answer counter for each correct answer.

If all correct then useok

If not all correct then usebad

<spacebar> useok OR usebad

<escape> mainmenu.

GREAT! YOU KNOW HOW TO CARE FOR THE PC WHEN IT IS NOT IN USE. YOU ALSO KNOW WHAT TO DO WHEN MOVING THE PC.

NOW YOU'LL LEARN HOW AND WHEN TO CLEAN THE PARTS OF THE PC.

<spacebar> for next screen
<escape> to return to main menu

LESSON: hardware	☐ **NEXT**	☐ **BACK**
UNIT: [illegible]	☐ **DATA**	☐ **HELP**
☐ **NEXT1**	☐ **LAB**	☐ **STOP**
☐ **BACK1**		

<spacebar> clncrt.
<escape> mainmenu

LESSON: hardware

UNIT: usebad

☐ NEXT1

☐ BACK1

☐ NEXT

☐ DATA

☐ LAB

☐ BACK

☐ HELP

☐ STOP

<spacebar> clncrt

<escape> mainmenu.

YOU DIDN'T GET ALL OF THE CORRECT ANSWERS SO LET'S REVIEW:

It is a good idea to keep the PC covered when not in use. So that was TRUE

Leave disk drives empty when not in use (except) for moving. So that was FALSE

Yes, all loose parts should be secured when moving the PC any distance. So that was TRUE

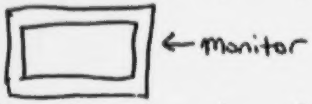
When moving the PC a long distance, it should be carefully packed if possible in original packing and according to instructions. So that was TRUE

NOW LET'S SEE HOW TO CLEAN THE PC !

<spacebar> for next screen
<escape> to return to main menu

LESSON: hardware
UNIT: clncpt

☐ **NEXT1**________
☐ **BACK1**________
☐ **NEXT**________
☐ **DATA**________
☐ **LAB**________
☐ **BACK**________
☐ **HELP**________
☐ **STOP**________



If youre monitor isn't kept clean, you will have trouble reading the information displayed on it. This can result in misinterpreted data as well as eye strain.

Because monitor screens generate electrical charges, dust is attracted to them

Be sure to periodically clean the screen with a static-free, lint-free cloth or pad. Additional ~~to~~ screen cleaning fluid can also be used.

<spacebar> to see more
(next screen)

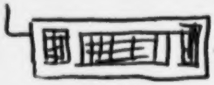
138 <escape> to return to main menu

<spacebar> to see each paragraph

when done change message on bottom to say --- next screen

then:

<spacebar> clnkeys.
<escape> mainmenu


← keyboard

Keyboards get dirty from fingerprints, oils and dirt from your hands as well as dust. They can also be seriously damaged if food or beverages get accidently spilled on them.

These things can cause keys to stick or internal parts to malfunction thus causing data entry errors from the keyboard.

Use special keyboard cleaning fluid and special swabs for cleaning the keys. Apply the fluid to a cloth or swab - not directly onto the keyboard!

Clean periodically or immediately if there has been a spillage, if errors occur or if any keys stick..

<spacebar> to see more (next screen)
<escape> to return to mainmenu
<F1> to go back a screen

LESSON: hardware
UNIT: clnkeys

☐ **NEXT** ________
☐ **BACK** ________
☐ **NEXT1** ________
☐ **DATA** ________
☐ **HELP** ________
☐ **BACK1** ________
☐ **LAB** ________
☐ **STOP** ________

<spacebar> to see each paragraph

When done change message on bottom to say --- next screen.

then:

<spacebar> clnprint
<escape> mainmenu
<F1> clncrt

← printer

If the print from your printer isn't legible then you may need to change the ribbon or clean the printer. Use special non-alcohol based printer cleaning fluid to do this so that the rubber parts don't dry up.

Dirt on the paper tractors can cause the paper to slip and jam. Thus proper cleaning of all printer parts is important.

Clean the printer on a regular basis or immediately if any problems occur

<spacebar> to see more
(next screen)
<escape> to return to mainmenu
<F1> to go back a screen

LESSON: hardware
UNIT: clnprint

☐ **NEXT** ______ ☐ **BACK** ______
☐ **NEXT1** ______ ☐ **DATA** ______ ☐ **HELP** ______
☐ **BACK1** ______ ☐ **LAB** ______ ☐ **STOP** ______

<spacebar> to see each paragraph
When done change message on bottom to say --- next screen
then:

<spacebar> clncpu
<escape> mainmenu
<F1> clnkeys

The "housing" of the PC is the plastic around each part. This also need cleaning from fingerprints, dirt and dust.

Use lint-free pads and special fluid for this.. Other hard to reach places can be safely cleaning using compressed air specially packaged for this use.

<spacebar> to see next screen.
<escape> to return to main menu
<F1> to go back a screen.

LESSON: hardware
UNIT: clncpu

☐ NEXT ______ ☐ BACK ______
☐ NEXT1 ______ ☐ DATA ______ ☐ HELP ______
☐ BACK1 ______ ☐ LAB ______ ☐ STOP ______

<spacebar> clndrive
<escape> mainmenu
<F1> clnprint

LESSON: hardware

UNIT: clndrive

☐ **NEXT1**

☐ **BACK1**

☐ **NEXT**

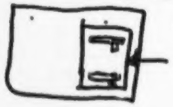
☐ **DATA**

☐ **LAB**

☐ **BACK**

☐ **HELP**

☐ **STOP**



The read/write head of a disk drive is like a phonograph needle or the head of a cassette machine. It must make full contact with the surface of the disk. If it doesn't, information can be distorted, skipped or destroyed.

Many things cause the disk drives to malfunction and need cleaning. Some are dust, dirt, smoke, hairs, fibers and oxides from the diskettes.

Use a disk drive cleaning kit to periodically clean the drives. Do so immediately if there are read/write errors. Kits usually consist of a special disk and fluid.

<spacebar> for more (next screen)

<escape> to return to main menu

<F1> to go back a screen.

<spacebar> to see each paragraph. When done change message on bottom to say - - - next screen then:

<spacebar> clnquiz

<escape> mainmenu

<F1> clncpu

Match the problem with the correct solution:

PROBLEM

1. Soda spilled on keyboard and keys stick!

2. It's hard to read the words on computer screen because of fingerprints.

3. Computer is missing data on disk and giving me "Read" errors.

SOLUTION

A. Clean monitor with lint-free cloth and special cleaning fluid

B. CLEAN DISK DRIVE WITH special cleaning kit

C. Clean keys of keyboard with special cleaning fluid applied to swabs.

Fill in the letter that goes with the correct number.

1. ____
2. ____
3. ____

<spacebar> to see next screen
<escape> to return to main menu.

LESSON: hardware
UNIT: clnquiz

☐ NEXT1 ____
☐ BACK1 ____
☐ NEXT ____
☐ DATA ____
☐ LAB ____
☐ BACK ____
☐ HELP ____
☐ STOP ____

correct answer:

C, A, B

increment right answer counter for each correct answer

If all correct then clnok
if not all correct then clnbad

<spacebar> clnok OR clnbad
<escape> mainmenu

VERY GOOD! You know what to clean if a problem occurs with the PC.

Remember to use cleaning products specially made for the PC.

Also, always follow manufacturer's instructions for using the cleaning products.

Let's continue for a few more hints and reminders about hardware maintenance.

<spacebar> to see next screen.

<escape> to return to main menu

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LESSON: hardware

UNIT: clnok

☐ **NEXT1** ___

☐ **BACK1** ___

☐ **NEXT** ___

☐ **DATA** ___

☐ **LAB** ___

☐ **BACK** ___

☐ **HELP** ___

☐ **STOP** ___

<spacebar> also

<escape> mainmenu.

151

You didn't get all of the answers right. The correct answers are:

1. C
2. A
3. B

If soda spills on keys - clean the keyboard!

If the screen is hard to read - clean the monitor!

If there are disk read errors - clean the disk drive!

Now for some more hints and reminders about Hardware Maintenance.

<spacebar> to see next screen
<escape> to return to the main menu.

LESSON: hardware
UNIT: cln bad

☐ NEXT ______ ☐ BACK ______
☐ NEXT1 ______ ☐ DATA ______ ☐ HELP ______
☐ BACK1 ______ ☐ LAB ______ ☐ STOP ______

<spacebar> also
<escape> mainmenu

LESSON: hardware
UNIT: also

☐ NEXT1
☐ BACK1
☐ NEXT
☐ DATA
☐ LAB
☐ BACK
☐ HELP
☐ STOP

Remember :

DON'T - smoke, eat or drink near the PC

DO - periodically clean the parts of the PC or immediately if there are any problems or an accidental spillage has occured.

DO - use a surge protector to guard against power surges.

DO - keep PC away from heat vents ~~and~~, radiators, and direct sunlight

154

<spacebar> for more
(next screen)
<escape> to return to mainmenu

<spacebar> for display of Don't and Do paragraphs. Then change message on bottom to say
---- next screen.

then

<spacebar> sunquiz
<escape> mainmenu

155

Just to make sure that you know your stuff :

Do use a ____ protector to guard against power surges.

Do keep the PC away from ____ sources such as direct sunlight, ~~vents~~ steam vents and radiators.

Do ____ any part of the PC that starts to malfunction or has had an accidental beverage spill on it.

156

<spacebar> to go to next screen.
<escape> to return to main menu

LESSON: hardware
UNIT: Surging

☐ **NEXT** ____
☐ **BACK** ____
☐ **NEXT1** ____
☐ **DATA** ____
☐ **HELP** ____
☐ **BACK1** ____
☐ **LAB** ____
☐ **STOP** ____

correct answers :
surge
heat
clean

If all correct then Sumok
If not all correct then Sumbad

Increment right answers counter for correct answers.
Increment wrong answer counter for wrong answers.

<spacebar> Sumok [OR] sumbad
<escape> Mainmenu.

157

LESSON: hardware
UNIT: sumok

☐ **NEXT** ____
☐ **BACK** ____
☐ **NEXT1** ____
☐ **DATA** ____
☐ **HELP** ____
☐ **BACK1** ____
☐ **LAB** ____
☐ **STOP** ____

Great - hit the <spacebar> to print the results of all of the questions you answered.

Then you can continue to the next lesson.

<spacebar> go to next screen

158

<spacebar> hrdprint

159

LESSON: hardware
UNIT: Sumbad

☐ **NEXT1**
☐ **BACK1**
☐ **NEXT**
☐ **DATA**
☐ **LAB**
☐ **BACK**
☐ **HELP**
☐ **STOP**

<spacebar> hrdprint

These are the correct answers:

Do use a surge protector to guard against power surges.

Do keep the PC away from heat sources such as direct sunlight, steam vents and radiators.

Do clean any part of the PC that starts to malfunction or has had an accidental beverage spill on it.

<spacebar> to go to next screen.

you have finished the HARDWARE MAINTENANCE section of this tutorial.

Press "P" to print the results of your quizes.

_____ correct

_____ wrong

<escape> to return to main menu

<spacebar> to go to next section

LESSON: hardware

UNIT: hrdprint

☐ **NEXT1**

☐ **BACK1**

☐ **NEXT**

☐ **DATA**

☐ **LAB**

☐ **BACK**

☐ **HELP**

☐ **STOP**

print results of quizes
look up variables for correct answer / wrong answer ratio.

P prints results

then.

<escape> mainmenu

<spacebar> flopintr

APPENDIX G

Authoring Package Comparison Matrix

AUTHORING PACKAGES TO CREATE CBT FOR PC MAINTENANCE

PRODUCT	UNISON	AUTHOR	ASAP!	QUEST	WEIGHT
PRICE	5	4	3	2	40%
SUPPORT	2	5	4	3	10%
DISTRIBUTION	5	2	1	2	10%
QUESTION FLEX	5	3	3	5	20%
DISPLAY FLEX	5	3	3	4	20%
SCORE	470	350	290	310	

PRICE - basic cost of package

SUPPORT - based on length of time provided by the software manufacturer

DISTRIBUTION - for outside use based on additional cost

QUESTION FLEXIBILITY - based on allowable number of fill-in questions per screen, number of menu options and types of questions available

DISPLAY FLEXIBILITY - based on redrawing portions of the screen (halves, quarters or any specified block), use of color and availability of graphics

---

Scoring is based on the following scale according to the designer's assessment of the demo program and other information provided by the software manufacturers:

1 - POOR
2 - BELOW AVERAGE
3 - AVERAGE
4 - ABOVE AVERAGE
5 - EXCELLENT

These four products were selected out of eight reviewed products for the following reason - they cost less than $1500.

APPENDIX H

Original Program Code

ORIGINAL VERSION OF PROJECT SOURCE CODE

```
unit    mainmenu
        choice,2
define  score
define  probnum
define  tempscor
define  grade
calc    score := 0
calc    probnum := 0
calc    tempscor := 0
calc    grade := 0
colorb  blue
erase
border  magenta
color   brwhite
default
at      5:28
write   MAIN MENU
box     6:26;4:38
at      10:10
write   Welcome to the world of PC's.  To learn about maintenance,
        type the letter associated with each lesson:

            H - Hardware Maintenance

            F - Floppy Diskette/Cartridge Care

            S - Software Maintenance

            E - ESD (Electro-Static Discharge)

            Q - Quit this program
pause   keys=h,f,s,e,q
keytype choice,h,f,s,e,q
if      choice = 0
.       jump    hardintr
elseif  choice = 4
.       end     lesson
else
.       jump    flopintr
endif

unit    hardintr
at      5:30
write   HARDWARE MAINTENANCE
box     6:28;4:51
at      10:10
write   TYPE THE LETTER CORRESPONDING TO THE ACTION YOU WANT TO PERFORM

                P - Take the PRETEST and skip this lesson
                    if you pass it
                    L - Go through this LESSON and be tested
                        as you go through it

                    M - Return to the MAIN MENU

kbranch p,pretest1
kbranch l,partintr
kbranch m,mainmenu

unit    flopintr
at      5:20
write   FLOPPY DISKETTE/CARTRIDGE CARE
at      8:20
write   SOFTWARE MAINTENANCE
at      11:20
write   ESD (Electro-Static Discharge)
at      16:10
write   These lessons are not operational.  Please press any key to
        return to the MAIN MENU.
pause   keys=all
jump    mainmenu

unit    pretest1
calc    tempscor := 0
calc    probnum := 0
calc    score := 0
border  yellow
at      1:35
color   ltgreen
write   PRETEST
color   brwhite
colorb  green
box     5:5;2:15;filled
colorb  ltmagenta
box     4:11;3:14;filled
at      3:11
write   [==]
at      4:11
write   [==]
colorb  blue
calc    probnum := probnum + 1
at      3:16
write   <--- These are the  ______________ .
long    14
arrow   3:35
holdok
holdno
lowcase
at      4:21
color   ltmagenta
answer  (disk,disc) drives
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
```

```
answer  (diskdrives,discdrives)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is DISKDRIVES.
endarrow
color   brwhite
at      6:6
write   /\
         \_____ This is called the ____________________.
calc    probnum := probnum + 1
long    15
arrow   7:33
holdok
holdno
lowcase
at      8:14
color   ltmagenta
answer  cpu
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
answer  (system,sistem) unit
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is CPU or SYSTEM UNIT
endarrow
color   brwhite
calc    probnum := probnum + 1
at      10:10
write   When moving the PC a short distance, if it has a hard drive,
        you should park the __________.
long    8
arrow   11:30
holdok
holdno
lowcase
at      12:10
color   ltmagenta
answer  (head,heads,drives,drive,discs,disks)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is HEADS
endarrow
color   brwhite
calc    probnum := probnum + 1
at      14:10
write   If you clean your monitor screen, use a cloth that is
        _________ - free to clean off dust and dirt.
long    6
arrow   15:10
holdok
```

```
holdno
lowcase
at      16:10
color   ltmagenta
answer  (lint,static)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is LINT
endarrow
color   brwhite
calc    probnum := probnum + 1
at      18:10
write   Use a ________ protector to guard against power fluctuations
        during electrical storms.
long    7
arrow   18:16
holdok
holdno
lowcase
at      20:10
color   ltmagenta
answer  (surge,serge)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is SURGE
endarrow
color   brwhite
do      bot1
pause   keys=space
kbranch space,pretest2

unit    pretest2
at      1:35
color   ltgreen
write   PRETEST
color   brwhite
at      5:10
write   Don't smoke or drink or __________ near the PC.
calc    probnum := probnum + 1
long    5
arrow   5:34
holdok
holdno
lowcase
at      6:10
color   ltmagenta
answer  (eat)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is EAT
```

```
endarrow
color   brwhite
calc    probnum := probnum + 1
at      9:10
write   If an accidental spillage on a part occurs, then you should
        __________ that part immediately!
long    7
arrow   10:10
holdok
holdno
lowcase
at      11:10
color   ltmagenta
answer  (clean,cleen,wipe)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
answer  wipe up
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is CLEAN
endarrow
color   brwhite
calc    probnum := probnum + 1
at      14:10
write   So that the rubber parts of the printer don't dry up,
        use ___________ - free cleaning solution.
long    9
arrow   15:14
holdok
holdno
lowcase
at      16:10
color   ltmagenta
answer  (alcohol,alcohal)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is ALCOHOL
endarrow
color   brwhite
calc    score := score + tempscor
at      21:10
write   YOU GOT
at      21:19
show    score
at      21:22
write   CORRECT OUT OF
at      21:37
show    probnum
at      21:40
write   PROBLEMS.
do      bot2
```

```
at      22:10
if      score > probnum - 2
.       write   YOU PASSED THE PRETEST, PRESS THE SPACEBAR TO PRINT RES
.       kbranch space,hrdprint
else
.       write   YOU FAILED THE PRETEST, PRESS THE SPACEBAR TO BEGIN THE
.       kbranch space,partintr
endif
kbranch esc,mainmenu

unit    bot1
colorb  magenta
at      24:7
write   <spacebar> to see more
colorb  blue

unit    bot2
colorb  magenta
at      24:7
write   <spacebar> to see next screen      <escape> to return to Main M
colorb  blue

unit    bot3
colorb  magenta
at      24:7
write   <spacebar> to see next screen      <escape> to return to main m
at      25:26
write   <F1> to go back a screen
colorb  blue

unit    partintr
calc    score := 0
calc    probnum := 0
at      10:10
write   What you are working on now is a PC.  That stands for
        Personal Computer.  It consists of different parts.
        Some are used for inputing and some are output devices.


        Press the SPACEBAR to see each part of the computer and
        a description of what it does!
do      bot2
kbranch space,partgrh
kbranch esc,mainmenu

unit    partgrh
colorb  yellow
box     5:25;1:35;filled
colorb  black
box     4:26;2:34;filled
colorb  blue
at      3:37
write   <--- MONITOR : used as an output
```

```
                device (touch screens also
                accept input)
do      botl
pause   keys=space
colorb  dkgrey
box     12:20;6:40;filled
colorb  blue
at      6:2
write   SYSTEM UNIT
        (the CPU -
        central -------->
        processing unit
        is inside) : the
        brains of the PC
pause   keys=space
colorb  cyan
box     11:32;7:38;filled
colorb  ltcyan
box     10:33;10:37;filled
at      10:34
color   black
write   ---
box     8:33;8:37;filled
at      8:34
write   ---
colorb  blue
at      7:42
color   brwhite
write   <--- DISK DRIVES : used to read from
             and write to floppy diskettes
pause   keys=space
colorb  ltgreen
box     18:21;13:39;filled
at      14:22
color   black
write   ############### #
        # ############# #
        # ############# #
           ###########
colorb  blue
at      14:42
color   brwhite
write   <-------- KEYBOARD : used as
                  an input device
pause   keys=space
colorb  ltred
box     21:5;17:15;filled
colorb  brwhite
box     19:7;15:13;filled
color   dkgrey
at      18:6
write   ---------
color   brwhite
```

```
colorb  blue
at      20:17
write   <----------------- PRINTER : used as
                           an output device
do      bot3
kbranch esc,mainmenu
kbranch space,partquiz
kbranch f1,partintr

unit    partquiz
        choice,2
calc    tempscor := 0
do      pc
colorb  blue
at      5:55
write   TYPE THE LETTER OF THE
        PART OF THE PC WHERE
        THE ARROW IS:

             a. PRINTER
             b. SYSTEM UNIT/CPU
             c. MONITOR
             d. KEYBOARD
             e. DISKDRIVES
calc    probnum := probnum + 1
at      3:37
write   <---
pause   keys=a,b,c,d,e
keytype choice,a,b,c,d,e
at      3:42
if      choice = 2
.       write   MONITOR
.       calc    tempscor := tempscor + 1
else
.       write   NO, it's a
.                  MONITOR
endif
calc    probnum := probnum + 1
at      8:14
write   |
        `--->
pause   keys=a,b,c,d,e
keytype choice,a,b,c,d,e
at      6:3
if      choice = 1
.       write   SYSTEM UNIT/CPU
.       calc    tempscor := tempscor + 1
else
.       write   NO, it's the
.               SYSTEM UNIT/CPU
endif
calc    probnum := probnum + 1
at      7:42
```

```
write   <---

pause   keys=a,b,c,d,e
keytype choice,a,b,c,d,e
at      9:42
if      choice = 4
.       write   DISKDRIVES
.       calc    tempscor := tempscor + 1
else
.       write   NO, it’s the
.                DISKDRIVES
endif
calc    probnum := probnum + 1
at      14:42
write   <---
pause   keys=a,b,c,d,e
keytype choice,a,b,c,d,e
at      14:47
if      choice = 3
.       write   KEYBOARD
.       calc    tempscor := tempscor + 1
else
.       write   NO, it’s a
.                KEYBOARD
endif
calc    probnum := probnum + 1
at      20:17
write   <---
pause   keys=a,b,c,d,e
keytype choice,a,b,c,d,e
at      20:25
if      choice = 0
.       write   PRINTER
.       calc    tempscor := tempscor + 1
else
.       write   NO, it’s a
.                KEYBOARD
endif
calc    score := score + tempscor
at      22:40
write   You got this many correct:
at      22:68
show    tempscor
do      bot3
kbranch esc,mainmenu
kbranch space,partok
kbranch f1,partgrh

unit    partok
do      pc
colorb  black
at      3:27
if      tempscor > 3
```

```
.       write   GREAT !
elseif  tempscor > 1
.       write   GOOD !!
else
.       write   STUDY !
endif
colorb  blue
do      bot2
kbranch esc,mainmenu
kbranch space,notinuse

unit    pc
draw    11:20;18:15
colorb  yellow
box     5:25;1:35;filled
colorb  black
box     4:26;2:34;filled
colorb  dkgrey
box     12:20;6:40;filled
colorb  cyan
box     11:32;7:38;filled
colorb  ltcyan
box     10:33;10:37;filled
at      10:34
color   black
write   ---
box     8:33;8:37;filled
at      8:34
write   ---
colorb  ltgreen
box     18:21;13:39;filled
at      14:22
write   ############### #
        # ############# #
        # ############# #
           ###########
colorb  ltred
box     21:5;17:15;filled
colorb  brwhite
box     19:7;15:13;filled
color   dkgrey
at      18:6
write   ---------
color   brwhite

unit    notinuse
at      5:10
write   When the PC is NOT IN USE, it is a good idea to cover it so
        that is is protected from dust or accidents.  Specially made
        covers are sold for this purpose.
do      bot1
pause   keys=space
at      10:10
```

```
write   DON'T put piles of papers on top of any of the parts of the PC.
        It is not a piece of furniture!
pause   keys=space
at      14:10
write   DON'T keep floppy disks in the disk drives -- they should be
        stored properly.  (more on that in a later lesson)
do      bot2
kbranch space,moving
kbranch esc,mainmenu

unit    moving
at      5:10
write   When MOVING the PC a SHORT DISTANCE, it is a good idea to:

          - make sure it is turned off
          - secure any loose parts (ie- printer parts & cords)
          - cover or wrap any delicate parts
          - park hard disk drive heads (refer to user's manual)
          - place a blank disk or special cardboard in disk drives
            and close doors.
do      bot1
pause   keys=space
at      15:10
write   If MOVING the PC a LONG DISTANCE, do ALL of the above and also:

          - wrap all parts in original packing material and boxes
          - follow manufacterer's instructions for packing
do      bot3
kbranch space,usequiz
kbranch esc,mainmenu
kbranch f1,notinuse

unit    usequiz
        choice,2
calc    tempscor := 0
at      2:10
write   Answer each question as TRUE or FALSE by typing a T or F
        next to each statement.  Use lower case letters (t or f).
calc    probnum := probnum + 1
at      6:10
write   It is a good idea to keep the PC covered when it is not
        in use. (t or f)?
pause   keys=t,f
keytype choice,t,f
at      8:20
color   ltcyan
if      choice = 0
.       write   CORRECT!
.       calc    tempscor := tempscor + 1
else
.       write   No, the answer is TRUE!
endif
color   brwhite
```

```
calc    probnum := probnum + 1
at      10:10
write   Keep floppy disks in the disk drives at all times; even
        when the PC is not in use. (t or f)?
pause   keys=t,f
keytype choice,t,f
at      12:20
color   ltcyan
if      choice = 1
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
else
.       write   No, the answer is FALSE!
endif
color   brwhite
calc    probnum := probnum + 1
at      14:10
write   When moving the PC a short distance, all loose parts should
        be secured or tied down. (t or f)?
pause   keys=t,f
keytype choice,t,f
at      16:20
color   ltcyan
if      choice = 0
.       write   RIGHT!
.       calc    tempscor := tempscor + 1
else
.       write   No, the answer is TRUE!
endif
color   brwhite
calc    probnum := probnum + 1
at      18:10
write   When moving the PC a long distance, it should be carefully
        packed in original boxes if possible and packed according
        to packing instructions. (t or f)?
pause   keys=t,f
keytype choice,t,f
at      21:20
color   ltcyan
if      choice = 0
.       write   CORRECT!
.       calc    tempscor := tempscor + 1
else
.       write   No, the answer is TRUE!
endif
color   brwhite
calc    score := score + tempscor
do      bot2
pause   keys=all
kbranch esc,mainmenu
if      tempscor > 3
.       jump    useok
else
```

```
.        jump    usebad
endif

unit     useok
at       7:20
write    GREAT!!!  YOU KNOW HOW TO CARE FOR THE

         PC WHEN IT IS NOT IN USE.  YOU ALSO KNOW

         WHAT TO DO WHEN MOVING THE PC!
at       15:20
write    NOW YOU WILL LEARN HOW AND WHEN TO CLEAN

         THE PARTS OF THE PC.
do       bot2
kbranch space,clncrt
kbranch esc,mainmenu

unit     usebad
at       10:20
write    HIT THE SPACE BAR TO LEARN NEXT ABOUT HOW

         AND WHEN TO CLEAN THE DIFFERENT PARTS OF

         THE PC!
do       bot2
kbranch space,clncrt
kbranch esc,mainmenu

unit     clncrt
colorb   yellow
box      5:5;1:15;filled
colorb   black
box      4:6;2:14;filled
colorb   blue
at       3:17
write    <--- MONITOR
at       10:10
write    If your monitor isn't kept clean, you will have trouble
         reading the information displayed on it.  This can result
         in misinterpreted data as well as eye strain.
do       bot1
pause    keys=space
at       14:10
write    Because monitor screens generate electrical charges, dust
         is attracted to them.
pause    keys=space
at       17:10
write    Be sure to periodically clean the screen with a static-free,
         lint-free cloth or pad.  Additional screen cleaning fluid
         can also be used.
do       bot2
kbranch esc,mainmenu
kbranch space,clnkeys

unit    clnkeys
colorb  ltgreen
box     6:5;1:23;filled
at      2:6
color   black
write   ############### #
        # ############# #
        # ############# #
           ###########
colorb  blue
color   brwhite
at      3:25
write   <--- KEYBOARD
at      8:10
write   Keyboards get dirty from fingerprints, oils and dirt from
        your hands as well as dust.  They can also be seriously
        damaged if food or beverages get accidently spilled on them.
do      bot1
pause   keys=space
at      12:10
write   These things can cause keys to stick or internal parts to
        malfunction thus causing data entry errors from the keyboard.
pause   keys=space
at      15:10
write   Use special keyboard cleaning fluid and special swabs for
        cleaning the keys.  Apply the fluid to a cloth or swab --
        not directly onto the keyboard!
pause   keys=space
at      19:10
write   Clean periodically or immediately if there has been a spillage,
        if errors occur or if any keys stick.
do      bot3
kbranch space,clnprint
kbranch esc,mainmenu
kbranch f1,clncrt

unit    clnprint
at      4:17
write   <----- PRINTER
colorb  ltred
box     7:5;3:15;filled
colorb  brwhite
box     5:7;1:13;filled
color   dkgrey
at      4:6
write   ---------
color   brwhite
colorb  blue
at      10:10
write   If the print from your printer isn't legible then you may need
        to change the ribbon or clean the printer.  Use special non-
        alcohol based printer cleaning fluid to do this so that the
        rubber parts don't dry up.
do      bot1
pause   keys=space
at      16:10
write   Dirt on the paper tractors can cause the paper to slip and jam.
        Thus proper cleaning of all printer parts is important.
pause   keys=space
at      20:10
write   Clean the printer on a regular basis or immediately if any
        problems occur.
do      bot3
kbranch space,clncpu
kbranch esc,mainmenu
kbranch f1,clnkeys

unit    clncpu
colorb  yellow
box     5:10;1:20;filled
colorb  black
box     4:11;2:19;filled
colorb  dkgrey
box     12:5;6:25;filled
colorb  blue
at      8:27
write   <------- HOUSING OF THE COMPNENTS
at      15:10
write   The housing around the components is the plastic around each
        part.  This also needs cleaning from fingerprints, dirt and dus
at      19:10
write   Use lint-free pads and special cleaning fluid for this.  Other
        hard to reach places can be safely cleaned using compressed air
        specially packaged for this use.
do      bot3
kbranch space,clndrive
kbranch esc,mainmenu
kbranch f1,clnprint

unit    clndrive
do      bot1
at      4:27
write   <------ DISK DRIVES
colorb  dkgrey
box     7:5;1:25;filled
colorb  cyan
box     6:17;2:23;filled
colorb  ltcyan
box     5:18;5:22;filled
at      5:19
color   black
write   ---
box     3:18;3:22;filled
at      3:19
```

```
write   ---
colorb  blue
color   brwhite
at      10:10
write   The read/write head of a disk drive is like the head of a
        cassette machine.  It floats about a micron away from the
        surface of the disk.  If it doesn't, information can be
        distorted, skipped or destroyed.
pause   keys=space
at      15:10
write   Many things cause the disk drives to malfunction and need
        cleaning.  Some are dust, dirt, smoke, hairs, fibers and oxides
        from the diskettes.
pause   keys=space
at      19:10
write   Use a disk drive cleaning kit to periodically clean the drives.
        Do so immediately if there are read/write errors.  Kits usually
        consist of a special disk and disk cleaning fluid.
do      bot3
kbranch esc,mainmenu
kbranch space,clnquiz
kbranch f1,clncpu

unit    clnquiz
        choice,2
calc    tempscor := 0
at      2:15
write   MATCH THE PROBLEM WITH THE CORRECT SOLUTION:
color   ltred
at      5:7
write   PROBLEM

        1.  Soda spilled on keyboard
            and keys stick.

        2.  Its hard to read the words
            on the computer screen
            because of fingerprints.

        3.  Computer is missing data on
            disk and giving me "read"
            errors.
color   ltgreen
at      5:44
write   SOLUTION

        a.  Clean monitor with a lint
            free cloth and special
            cleaning fluid.

        b.  Clean disk drive with special
            cleaning kit.
```

```
          c.  Clean keys of keyboard with
              special cleaning fluid applied
              to swabs.
color     brwhite
at        18:10
write     FILL IN THE LETTER OF THE SOLUTION THAT GOES WITH THE PROBLEM.
at        20:20
write     1.
at        20:30
write     2.
at        20:40
write     3.
calc      probnum := probnum + 1
pause     keys=a,b,c
keytype   choice,a,b,c
at        20:23
if        choice = 2
.         write   GOOD
.         calc    tempscor := tempscor + 1
else
.         write   NO
endif
calc      probnum := probnum + 1
pause     keys=a,b,c
keytype   choice,a,b,c
at        20:33
if        choice = 0
.         write   GREAT
.         calc    tempscor := tempscor + 1
else
.         write   NO
endif
calc      probnum := probnum + 1
pause     keys=a,b,c
keytype   choice,a,b,c
at        20:43
if        choice = 1
.         write   FANTASTIC
.         calc    tempscor := tempscor + 1
else
.         write   NO
endif
calc      score := score + tempscor
at        22:40
write     This is your score so far:
at        22:68
show      score
do        bot2
pause     keys=all
kbranch   esc,mainmenu
if        tempscor < 3
.         jump    clnbad
else
```

```
.        jump    clnok
endif

unit     clnok
at       5:10
write    VERY GOOD !!! You know what to clean if a problem occurs
         with the PC.
at       9:10
write    Remember to use cleaning products specially made for the PC.
at       12:10
write    Also, always follow manufacterer's instructions for using
         the cleaning products.
at       16:10
write    Let's continue for a few more hints and reminders about
         Hardware Maintenance.
do       bot2
kbranch esc,mainmenu
kbranch space,also

unit     clnbad
at       5:10
write    You didn't get all of the answers right.  The correct answers
         are:
                1. c          2. a          3. b
at       10:10
write    If soda spills on keys -- clean the keyboard!

         If the screen is hard to read -- clean the monitor!

         If there are disk read errors -- clean the disk drives!
at       18:10
write    Now for some more hints and reminders about Hardware Maintenanc
do       bot2
kbranch esc,mainmenu
kbranch space,also

unit     also
at       5:30
write    REMEMBER :
         ----------
at       9:10
write    DON'T -- smoke, eat or drink near the PC.
do       bot1
pause    keys=space
at       12:10
write    DO ----- periodically clean the parts of the PC or immediately
                  if there are any problems or an accidental spillage
                  has occured.
pause    keys=space
at       17:10
write    DO ----- use a surge protector to guard against power spikes.
pause    keys=space
at       20:10
```

```
write   DO ----- keep PC away from heat vents, radiators, and direct
                 sunlight.
do      bot2
kbranch esc,mainmenu
kbranch space,sumquiz

unit    sumquiz
calc    tempscor := 0
at      2:10
write   Just to make sure that you know your stuff:
calc    probnum := probnum + 1
at      5:10
write   DO use a _____________ protector to guard against power surges!
long    10
arrow   5:19
holdok
holdno
lowcase
at      7:20
answer  (surge,serge)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is SURGE
endarrow
calc    probnum := probnum + 1
at      10:10
write   DO keep the PC away from _________ sources such as direct sunli
        steam vents and radiators.
long    6
arrow   10:35
holdok
holdno
lowcase
at      13:20
answer  (heat,heet)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is HEAT
endarrow
calc    probnum := probnum + 1
at      16:10
write   DO ___________ any part of the PC that starts to malfunction
        or has had a beverage accidentally spilled on it.
long    8
arrow   16:14
holdok
holdno
lowcase
at      19:20
answer  (clean,cleen,clen,clene)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is CLEAN
endarrow
calc    score := score + tempscor
at      20:10
write   score     tempscor  probnum
at      21:10
show    score
at      21:20
show    tempscor
at      21:30
show    probnum
do      bot2
pause   keys=all
kbranch esc,mainmenu
if      tempscor < 3
.       jump    sumbad
else
.       jump    sumok
endif

unit    sumok
at      3:15
write   GREAT !!!  ---  Hit the <spacebar> to go to the next

        screen so you can print the results of all of the

        questions you answered.

        THEN, you can continue to the next lesson!
colorb  yellow
box     15:25;11:35;filled
colorb  black
box     14:26;12:34;filled
at      12:28
write   o   o
          v
        \___/
colorb  dkgrey
box     22:20;16:40;filled
colorb  cyan
box     21:32;17:38;filled
colorb  ltcyan
box     20:33;20:37;filled
at      20:34
color   black
write   ---
box     18:33;18:37;filled
at      18:34
write   ---
colorb  blue
color   brwhite
```

```
do      bot2
kbranch esc,mainmenu
kbranch space,hrdprint

unit    sumbad
at      5:10
write   SORRY, you didn't get all of the answers correct.  These are
        the correct answers:

        DO use a SURGE protector to guard against power surges.

        DO keep the PC away from HEAT sources such as direct sunlight,
        steam vents and radiators.

        DO CLEAN any part of the PC that starts to malfunction or has
        had a beverage accidentally spilled on it.


               Now press the <spacebar> to go to the next screen
               and print the results of the questions you answered!
do      bot2
kbranch esc,mainmenu
kbranch space,hrdprint

unit    hrdprint
at      5:7
write   YOU HAVE FINISHED THE HARDWARE MAINTENANCE SECTION OF THIS TUTO

        Hold the Alt key down and press the Print Screen key to
        print the results of your quizes.
at      15:15
show    score
calc    tempscor := probnum - score
at      17:15
show    tempscor
at      15:20
write   CORRECT

        WRONG
pause   keys=all
colorb  magenta
at      24:7
write   <spacebar> to return to the MAIN MENU
colorb  blue
kbranch space,mainmenu
```

APPENDIX I

Sample Session Screens

MAIN MENU

Welcome to the world of PC's. To learn about maintenance, type the letter associated with each lesson:

H - Hardware Maintenance

F - Floppy Diskette/Cartridge Care

S - Software Maintenance

E - ESD (Electro-Static Discharge)

Q - Quit this program

HARDWARE MAINTENANCE

TYPE THE LETTER CORRESPONDING TO THE ACTION YOU WANT TO PERFORM:

P - Take the PRETEST and skip this lesson
    if you pass it

L - Go through this LESSON and be tested
    as you go through it

M - Return to the MAIN MENU

PRETEST

```
    [==] <--- These are the  _diskdrives___ .
    [==]      VERY GOOD!

/\
 \_____ This is called the »_i don't know______.
```

NAME THE PART OF THE PC THAT THE ARROW IS POINTING TO.

```
                              PRETEST

     [==] <--- These are the  _diskdrives___ .
     [==]      VERY GOOD!

/\
 \_____ This is called the  _i don't know______.
        NO, the answer is CPU or SYSTEM UNIT

    When moving the PC a short distance, if it has a hard drive,
    you should park the  _what?___.
    NO, the answer is HEADS

    If you clean your monitor screen, use a cloth that is
     _lint___ - free to clean off dust and dirt.
    GREAT!

    Use a  _static protector to guard against power fluctuations
    during electrical storms.
    NO, the answer is SURGE


 <spacebar> to see more
```

PRETEST

```
Don't smoke or drink or  _eat_____ near the PC.
VERY GOOD!


If an accidental spillage on a part occurs, then you should
 _clean___ that part immediately!
VERY GOOD!


So that the rubber parts of the printer don't dry up,
use  _water____ - free cleaning solution.
NO, the answer is ALCOHOL




YOU GOT  4  CORRECT OUT OF 8  PROBLEMS.
YOU FAILED THE PRETEST, PRESS THE SPACEBAR TO BEGIN THE LESSON!

<spacebar> to see next screen      <escape> to return to Main Menu
```

What you are working on now is a PC. That stands for Personal Computer. It consists of different parts. Some are used for inputing and some are output devices.

Press the SPACEBAR to see each part of the computer and a description of what it does!

<spacebar> to see next screen   <escape> to return to Main Menu

```
                                   <--- MONITOR : used as an output
                                        device (touch screens also
                                        accept input)
SYSTEM UNIT
(the CPU -                              <--- DISK DRIVES : used to read from
central -------->               ---          and write to floppy diskettes
processing unit
is inside) : the                ---
brains of the PC


                    ################ #   <-------- KEYBOARD : used as
                    # ############## #             an input device
                    # ############## #
                       ###########
    ---------

               <------------------ PRINTER : used as
                                  an output device


     <spacebar> to see next screen      <escape> to return to main menu
                        <F1> to go back a screen
```

```
                                 <---  MONITOR
                                                   TYPE A LETTER (a thru e)
                                                   OF THE PART WHERE THE
NO, it's the                                       ARROW IS AND THEN HIT
SYSTEM UNIT/CPU                       <---,        THE RETURN KEY:
          |                   ---          |
          `--->                        NO, it's the     a. PRINTER
                              ---       DISKDRIVES      b. SYSTEM UNIT/CPU
                                                        c. MONITOR
                                                        d. KEYBOARD
                                                        e. DISKDRIVES
                  ############### #   <---  KEYBOARD
                  # ############# #
                  # ############# #
                     ###########

  ---------

             <---  PRINTER

                                    You got this many correct:  3

   <spacebar> to see next screen      <escape> to return to main menu
                      <F1> to go back a screen
```

```
                        GOOD !!



                                 ---

                                 ---



                   ############### #
                   # ############# #
                   # ############# #
                      ###########
---------



 <spacebar> to see next screen         <escape> to return to Main Menu
```

When the PC is NOT IN USE, it is a good idea to cover it so that is is protected from dust or accidents. Specially made covers are sold for this purpose.

DON'T put piles of papers on top of any of the parts of the PC. It is not a piece of furniture!

DON'T keep floppy disks in the disk drives -- they should be stored properly. (more on that in a later lesson)

<spacebar> to see next screen   <escape> to return to Main Menu

When MOVING the PC a SHORT DISTANCE, it is a good idea to:

- make sure it is turned off
- secure any loose parts (ie- printer parts & cords)
- cover or wrap any delicate parts
- park hard disk drive heads (refer to user's manual)
- place a blank disk or special cardboard in disk drives and close doors.

If MOVING the PC a LONG DISTANCE, do ALL of the above and also:

- wrap all parts in original packing material and boxes
- follow manufacterer's instructions for packing

<spacebar> to see next screen   <escape> to return to main menu
<F1> to go back a screen

```
Answer each question as TRUE or FALSE by typing a T or F
next to each statement.  Use lower case letters (t or f).


It is a good idea to keep the PC covered when it is not
in use. (t or f)?     t
          CORRECT!

Keep floppy disks in the disk drives at all times; even
when the PC is not in use. (t or f)?      f
          VERY GOOD!

When moving the PC a short distance, all loose parts should
be secured or tied down. (t or f)?    t
          RIGHT!

When moving the PC a long distance, it should be carefully
packed in original boxes if possible and packed according
to packing instructions. (t or f)?     t
          CORRECT!

<spacebar> to see next screen      <escape> to return to Main Menu
```

GREAT!!! YOU KNOW HOW TO CARE FOR THE PC WHEN IT IS NOT IN USE. YOU ALSO KNOW WHAT TO DO WHEN MOVING THE PC!

NOW YOU WILL LEARN HOW AND WHEN TO CLEAN THE PARTS OF THE PC.

<spacebar> to see next screen   <escape> to return to Main Menu

<--- MONITOR

If your monitor isn't kept clean, you will have trouble reading the information displayed on it. This can result in misinterpreted data as well as eye strain.

Because monitor screens generate electrical charges, dust is attracted to them.

Be sure to periodically clean the screen with a static-free, lint-free cloth or pad. Additional screen cleaning fluid can also be used.

<spacebar> to see next screen <escape> to return to Main Menu

```
############### #
# ############# #   <--- KEYBOARD
# ############# #
   ###########
```

Keyboards get dirty from fingerprints, oils and dirt from your hands as well as dust. They can also be seriously damaged if food or beverages get accidently spilled on them.

These things can cause keys to stick or internal parts to malfunction thus causing data entry errors from the keyboard.

Use special keyboard cleaning fluid and special swabs for cleaning the keys. Apply the fluid to a cloth or swab -- not directly onto the keyboard!

Clean periodically or immediately if there has been a spillage, if errors occur or if any keys stick.

<spacebar> to see next screen   <escape> to return to main menu
<F1> to go back a screen

--------- <----- PRINTER

If the print from your printer isn't legible then you may need to change the ribbon or clean the printer. Use special non-alcohol based printer cleaning fluid to do this so that the rubber parts don't dry up.

Dirt on the paper tractors can cause the paper to slip and jam. Thus proper cleaning of all printer parts is important.

Clean the printer on a regular basis or immediately if any problems occur.

<spacebar> to see next screen <escape> to return to main menu
<F1> to go back a screen

<------- HOUSING OF THE COMPNENTS

The housing around the components is the plastic around each part. This also needs cleaning from fingerprints, dirt and dust.

Use lint-free pads and special cleaning fluid for this. Other hard to reach places can be safely cleaned using compressed air specially packaged for this use.

<spacebar> to see next screen   <escape> to return to main menu
<F1> to go back a screen

```
          ---
                    <------ DISK DRIVES
          ---


    The read/write head of a disk drive is like the head of a
    cassette machine.  It floats about a micron away from the
    surface of the disk.  If it doesn't, information can be
    distorted, skipped or destroyed.

    Many things cause the disk drives to malfunction and need
    cleaning.  Some are dust, dirt, smoke, hairs, fibers and oxides
    from the diskettes.

    Use a disk drive cleaning kit to periodically clean the drives.
    Do so immediately if there are read/write errors.  Kits usually
    consist of a special disk and disk cleaning fluid.

 <spacebar> to see next screen      <escape> to return to main menu
                   <F1> to go back a screen
```

MATCH THE PROBLEM WITH THE CORRECT SOLUTION:

PROBLEM	SOLUTION
1. Soda spilled on keyboard and keys stick.	a. Clean monitor with a lint free cloth and special cleaning fluid.
2. Its hard to read the words on the computer screen because of fingerprints.	b. Clean disk drive with special cleaning kit.
3. Computer is missing data on disk and giving me "read" errors.	c. Clean keys of keyboard with special cleaning fluid applied to swabs.

FILL IN THE LETTER OF THE SOLUTION THAT GOES WITH THE PROBLEM.

1. c	2. a	3. b
GOOD	GREAT	FANTASTIC

This is your score so far: 10

<spacebar> to see next screen <escape> to return to Main Menu

VERY GOOD !!! You know what to clean if a problem occurs with the PC.

Remember to use cleaning products specially made for the PC.

Also, always follow manufacterer's instructions for using the cleaning products.

Let's continue for a few more hints and reminders about Hardware Maintenance.

<spacebar> to see next screen   <escape> to return to Main Menu

REMEMBER :

DON'T -- smoke, eat or drink near the PC.

DO ----- periodically clean the parts of the PC or immediately if there are any problems or an accidental spillage has occured.

DO ----- use a surge protector to guard against power spikes.

DO ----- keep PC away from heat vents, radiators, and direct sunlight.

<spacebar> to see next screen   <escape> to return to Main Menu

Just to make sure that you know your stuff:

DO use a _surge______ protector to guard against power surges!

VERY GOOD!

DO keep the PC away from _heat___ sources such as direct sunlight, steam vents and radiators.

GREAT!

DO _ _clean___ any part of the PC that starts to malfunction or has had a beverage accidentally spilled on it.

GREAT!

Your score so far is: 13

<spacebar> to see next screen   <escape> to return to Main Menu

GREAT !!! --- Hit the <spacebar> to go to the next screen so you can print the results of all of the questions you answered.

THEN, you can continue to the next lesson!

```
      o   o
        v
      \___/


              ---

              ---
```

<spacebar> to see next screen   <escape> to return to Main Menu

YOU HAVE FINISHED THE HARDWARE MAINTENANCE SECTION OF THIS TUTORIAL!

Hold the Alt key down and press the Print Screen key to print the results of your quizes.

13 CORRECT

2 WRONG

<spacebar> to return to the MAIN MENU

APPENDIX J

Post Learning Questionnaire

Post test questionaire:

Please respond to each question by circling:
SA - if you STRONGLY AGREE with the statement
A - if you AGREE with the statement
D - if you DISAGREE with the statement
SD - if you STRONGLY DISAGREE with the statement

1. The lesson was interesting. SA A D SD

2. The lesson was the right length. SA A D SD

3. The lesson was easy to understand. SA A D SD

4. The lesson required a high degree of user interaction.
SA A D SD

5. The instructions were easy to understand. SA A D SD

6. The information was useful. SA A D SD

7. The information can be used on the job. SA A D SD

8. The lesson should be given to all employees. SA A D SD

9. Most PC breakdowns are caused by carelessness or improper maintenance.
SA A D SD

10. This lesson will help decrease the amount of PC repairs needed.
SA A D SD

Please circle the answers that apply to you:

I am:
male female

My age is:
under 20 20-25 26-35 36-45 46-55 over 56

The highest education that I have completed:

high school	some college
college	some graduate school
graduate school	some doctoral school
doctoral school	

I have been with the company:
under 3 years
between 3 and 7 years
between 8 and 15 years
over 16 years

APPENDIX K

Final Version of Program Code

FINAL VERSION OF PROJECT SOURCE CODE

```
unit    mainmenu
        choice,2
define  score
define  probnum
define  tempscor
define  grade
calc    score := 0
calc    probnum := 0
calc    tempscor := 0
colorb  blue
erase
border  magenta
color   brwhite
default
at      5:28
write   MAIN MENU
box     6:26;4:38
at      10:10
write   Welcome to the world of PC's.  To learn about maintenance,
        type the letter associated with each lesson:

            H - Hardware Maintenance

            F - Floppy Diskette/Cartridge Care

            S - Software Maintenance

            E - ESD (Electro-Static Discharge)

            Q - Quit this program
pause   keys=h,f,s,e,q
keytype choice,h,f,s,e,q
if      choice = 0
.       jump    hardintr
elseif  choice = 4
.       end     lesson
else
.       jump    flopintr
endif

unit    hardintr
at      5:30
write   HARDWARE MAINTENANCE
box     6:28;4:51
at      10:10
write   TYPE THE LETTER CORRESPONDING TO THE ACTION YOU WANT TO PERFORM

                P - Take the PRETEST and skip this lesson
                    if you pass it

                L - Go through this LESSON and be tested
```

```
                      as you go through it

                  M - Return to the MAIN MENU

kbranch p,pretest1
kbranch l,partintr
kbranch m,mainmenu

unit    flopintr
at      5:20
write   FLOPPY DISKETTE/CARTRIDGE CARE
at      8:20
write   SOFTWARE MAINTENANCE
at      11:20
write   ESD (Electro-Static Discharge)
at      16:10
write   These lessons are not operational.  Please press any key to
        return to the MAIN MENU.
pause   keys=all
jump    mainmenu

unit    pretest1
border  yellow
at      1:35
color   ltgreen
write   PRETEST
color   brwhite
colorb  green
box     5:5;2:15;filled
colorb  ltmagenta
box     4:11;3:14;filled
at      3:11
write   [==]
        [==]
colorb  blue
at      11:15
write   NAME THE PART OF THE PC THAT THE ARROW IS POINTING TO.
calc    probnum := probnum + 1
at      3:16
write   <--- These are the  ______________ .
long    14
color   ltgreen
arrow   3:35
holdok
holdno
lowcase
at      4:21
color   ltmagenta
answer  (disk,disc) drives
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
answer  (diskdrives,discdrives)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is DISKDRIVES.
endarrow
color   brwhite
at      6:6
write   /\
         \_____ This is called the ____________________.
calc    probnum := probnum + 1
long    15
color   ltgreen
arrow   7:33
holdok
holdno
lowcase
at      8:14
color   ltmagenta
answer  cpu
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
answer  (system,sistem) unit
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is CPU or SYSTEM UNIT
endarrow
at      11:15
erase   60
color   brwhite
calc    probnum := probnum + 1
at      10:10
write   When moving the PC a short distance, if it has a hard drive,
        you should park the __________.
long    8
color   ltgreen
arrow   11:30
holdok
holdno
lowcase
at      12:10
color   ltmagenta
answer  (head,heads,drives,drive,discs,disks)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is HEADS
endarrow
color   brwhite
calc    probnum := probnum + 1
at      14:10
write   If you clean your monitor screen, use a cloth that is
        _________ - free to clean off dust and dirt.
long    6
```

```
color   ltgreen
arrow   15:10
holdok
holdno
lowcase
at      16:10
color   ltmagenta
answer  (lint,static)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is LINT
endarrow
color   brwhite
calc    probnum := probnum + 1
at      18:10
write   Use a ________ protector to guard against power fluctuations
        during electrical storms.
long    7
color   ltgreen
arrow   18:16
holdok
holdno
lowcase
at      20:10
color   ltmagenta
answer  (surge,serge)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is SURGE
endarrow
color   brwhite
do      bot1
pause   keys=space
kbranch space,pretest2

unit    pretest2
at      1:35
color   ltgreen
write   PRETEST
color   brwhite
at      5:10
write   Don't smoke or drink or __________ near the PC.
calc    probnum := probnum + 1
long    5
color   ltgreen
arrow   5:34
holdok
holdno
lowcase
at      6:10
color   ltmagenta
```

```
answer  (eat)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is EAT
endarrow
color   brwhite
calc    probnum := probnum + 1
at      9:10
write   If an accidental spillage on a part occurs, then you should
        __________ that part immediately!
long    7
color   ltgreen
arrow   10:10
holdok
holdno
lowcase
at      11:10
color   ltmagenta
answer  (clean,cleen,wipe)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
answer  wipe up
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is CLEAN
endarrow
color   brwhite
calc    probnum := probnum + 1
at      14:10
write   So that the rubber parts of the printer don't dry up,
        use ___________ - free cleaning solution.
long    9
color   ltgreen
arrow   15:14
holdok
holdno
lowcase
at      16:10
color   ltmagenta
answer  (alcohol,alcohal)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is ALCOHOL
endarrow
color   brwhite
calc    score := score + tempscor
at      21:10
write   YOU GOT
at      21:19
show    score
```

```
at      21:22
write   CORRECT OUT OF
at      21:37
show    probnum
at      21:40
write   PROBLEMS.
do      bot2
at      22:10
if      score > probnum - 2
.       write   YOU PASSED THE PRETEST, PRESS THE SPACEBAR TO PRINT RES
.       kbranch space,hrdprint
else
.       write   YOU FAILED THE PRETEST, PRESS THE SPACEBAR TO BEGIN THE
.       kbranch space,partintr
endif
kbranch esc,mainmenu

unit    bot1
colorb  magenta
at      24:7
write   <spacebar> to see more
colorb  blue

unit    bot2
colorb  magenta
at      24:7
write   <spacebar> to see next screen      <escape> to return to Main M
colorb  blue

unit    bot3
colorb  magenta
at      24:7
write   <spacebar> to see next screen      <escape> to return to main m
at      25:26
write   <F1> to go back a screen
colorb  blue

unit    partintr
calc    score := 0
calc    probnum := 0
at      10:10
write   What you are working on now is a PC.  That stands for
        Personal Computer.  It consists of different parts.
        Some are used for inputing and some are output devices.


        Press the SPACEBAR to see each part of the computer and
        a description of what it does!
do      bot2
kbranch space,partgrh
kbranch esc,mainmenu

unit    partgrh
```

```
colorb  yellow
box     5:25;1:35;filled
colorb  black
box     4:26;2:34;filled
colorb  blue
at      3:37
write   <--- MONITOR : used as an output
             device (touch screens also
             accept input)
do      bot1
pause   keys=space
colorb  dkgrey
box     12:20;6:40;filled
colorb  blue
at      6:2
write   SYSTEM UNIT
        (the CPU -
        central -------->
        processing unit
        is inside) : the
        brains of the PC
pause   keys=space
colorb  cyan
box     11:32;7:38;filled
colorb  ltcyan
box     10:33;10:37;filled
at      10:34
color   black
write   ---
box     8:33;8:37;filled
at      8:34
write   ---
colorb  blue
at      7:42
color   brwhite
write   <--- DISK DRIVES : used to read from
             and write to floppy diskettes
pause   keys=space
colorb  ltgreen
box     18:21;13:39;filled
at      14:22
color   black
write   ################ #
        # ############## #
        # ############## #
           ###########
colorb  blue
at      14:42
color   brwhite
write   <-------- KEYBOARD : used as
                  an input device
pause   keys=space
colorb  ltred
```

```
box     21:5;17:15;filled
colorb  brwhite
box     19:7;15:13;filled
color   dkgrey
at      18:6
write   ---------
color   brwhite
colorb  blue
at      20:17
write   <------------------ PRINTER : used as
                            an output device
do      bot3
kbranch esc,mainmenu
kbranch space,partquiz
kbranch f1,partintr

unit    partquiz
        choice,2
calc    tempscor := 0
do      pc
colorb  blue
at      4:55
write   TYPE A LETTER (a thru e)
        OF THE PART WHERE THE
        ARROW IS AND THEN HIT
        THE RETURN KEY:

             a. PRINTER
             b. SYSTEM UNIT/CPU
             c. MONITOR
             d. KEYBOARD
             e. DISKDRIVES
calc    probnum := probnum + 1
at      3:37
write   <---
long    1
arrow   3:42
clrans
at      22:35
erase   30,2
holdok
holdno
lowcase
at      3:43
answer  c
.       write   MONITOR
.       calc    tempscor := tempscor + 1
answer  (a,b,d,e)
.       write   NO, it's a
.                  MONITOR
no
.       at      22:35
.       write   SELECT A LETTER FROM a TO e !
.                   press RETURN and try again.
endarrow
calc    probnum := probnum + 1
at      8:14
write   |
        `--->
long    1
arrow   6:3
clrans
at      22:35
erase   30,2
holdok
holdno
lowcase
at      6:4
answer  b
.       write   SYSTEM UNIT/CPU
.       calc    tempscor := tempscor + 1
answer  (a,c,d,e)
.       write   NO, it's the
.               SYSTEM UNIT/CPU
no
.       at      22:35
.       write   SELECT A LETTER FROM a TO e !
.                press RETURN and try again.
endarrow
calc    probnum := probnum + 1
at      7:42
write   <---,
            |
long    1
arrow   9:42
clrans
at      22:35
erase   30,2
holdok
holdno
lowcase
at      9:43
answer  e
.       write   DISKDRIVES
.       calc    tempscor := tempscor + 1
answer  (a,b,c,d)
.       write   NO, it's the
.                DISKDRIVES
no
.       at      22:35
.       write   SELECT A LETTER FROM a TO e !
.                press RETURN and try again.
endarrow
calc    probnum := probnum + 1
at      14:42
write   <---
```

```
long    1
arrow   14:47
clrans
at      22:35
erase   30,2
holdok
holdno
lowcase
at      14:48
answer  d
.       write   KEYBOARD
.       calc    tempscor := tempscor + 1
answer  (a,b,c,e)
.       write   NO, it's a
.                KEYBOARD
no
.       at      22:35
.       write   SELECT A LETTER FROM a TO e !
.                press RETURN and try again.
endarrow
jumpop  prtquiz2

unit    prtquiz2
calc    probnum := probnum + 1
at      20:17
write   <---
long    1
arrow   20:22
clrans
at      22:35
erase   30,2
holdok
holdno
lowcase
at      20:23
answer  a
.       write   PRINTER
.       calc    tempscor := tempscor + 1
answer  (b,c,d,e)
.       write   NO, it's a
.                PRINTER
no
.       at      22:35
.       write   SELECT A LETTER FROM a TO e !
.                press RETURN and try again.
endarrow
calc    score := score + tempscor
at      22:40
write   You got this many correct:
at      22:68
show    tempscor
do      bot3
kbranch esc,mainmenu
kbranch space,partok
kbranch f1,partgrh

unit    partok
do      pc
colorb  black
at      3:27
if      tempscor > 3
.       write   GREAT !
elseif  tempscor > 1
.       write   GOOD !!
else
.       write   STUDY !
endif
colorb  blue
do      bot2
kbranch esc,mainmenu
kbranch space,notinuse

unit    pc
draw    11:20;18:15
colorb  yellow
box     5:25;1:35;filled
colorb  black
box     4:26;2:34;filled
colorb  dkgrey
box     12:20;6:40;filled
colorb  cyan
box     11:32;7:38;filled
colorb  ltcyan
box     10:33;10:37;filled
at      10:34
color   black
write   ---
box     8:33;8:37;filled
at      8:34
write   ---
colorb  ltgreen
box     18:21;13:39;filled
at      14:22
write   ############### #
        # ############# #
        # ############# #
           ###########
colorb  ltred
box     21:5;17:15;filled
colorb  brwhite
box     19:7;15:13;filled
color   dkgrey
at      18:6
write   ---------
color   brwhite
```

```
unit    notinuse
at      5:10
write   When the PC is NOT IN USE, it is a good idea to cover it so
        that is is protected from dust or accidents.  Specially made
        covers are sold for this purpose.
do      bot1
pause   keys=space
at      10:10
write   DON'T put piles of papers on top of any of the parts of the PC.
        It is not a piece of furniture!
pause   keys=space
at      14:10
write   DON'T keep floppy disks in the disk drives -- they should be
        stored properly.  (more on that in a later lesson)
do      bot2
kbranch space,moving
kbranch esc,mainmenu

unit    moving
at      5:10
write   When MOVING the PC a SHORT DISTANCE, it is a good idea to:

          - make sure it is turned off
          - secure any loose parts (ie- printer parts & cords)
          - cover or wrap any delicate parts
          - park hard disk drive heads (refer to user's manual)
          - place a blank disk or special cardboard in disk drives
            and close doors.
do      bot1
pause   keys=space
at      15:10
write   If MOVING the PC a LONG DISTANCE, do ALL of the above and also:

          - wrap all parts in original packing material and boxes
          - follow manufacterer's instructions for packing
do      bot3
kbranch space,usequiz
kbranch esc,mainmenu
kbranch f1,notinuse

unit    usequiz
        choice,2
calc    tempscor := 0
at      2:10
write   Answer each question as TRUE or FALSE by typing a T or F
        next to each statement.  Use lower case letters (t or f).
calc    probnum := probnum + 1
at      6:10
write   It is a good idea to keep the PC covered when it is not
        in use. (t or f)?
long    1
arrow   7:30
clrans
```

```
at      22:15
erase   55
holdok
holdno
lowcase
at      8:20
color   ltcyan
answer  t
.       write   CORRECT!
.       calc    tempscor := tempscor + 1
answer  f
.       write   No, the answer is TRUE!
no
.       at      22:15
.       write   PRESS EITHER t or f (press RETURN and try again)!
endarrow
color   brwhite
calc    probnum := probnum + 1
at      10:10
write   Keep floppy disks in the disk drives at all times; even
        when the PC is not in use. (t or f)?
long    1
arrow   11:50
clrans
at      22:15
erase   55
holdok
holdno
lowcase
at      12:20
color   ltcyan
answer  f
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
answer  t
.       write   No, the answer is FALSE!
no
.       at      22:15
.       write   PRESS EITHER t or f (press RETURN and try again)!
endarrow
color   brwhite
calc    probnum := probnum + 1
at      14:10
write   When moving the PC a short distance, all loose parts should
        be secured or tied down. (t or f)?
long    1
arrow   15:46
clrans
at      22:15
erase   55
holdok
holdno
lowcase
```

```
at      16:20
color   ltcyan
answer  t
.       write   RIGHT!
.       calc    tempscor := tempscor + 1
answer  f
.       write   No, the answer is TRUE!
no
.       at      22:15
.       write   PRESS EITHER t or f (press RETURN and try again)!
endarrow
color   brwhite
calc    probnum := probnum + 1
at      18:10
write   When moving the PC a long distance, it should be carefully
        packed in original boxes if possible and packed according
        to packing instructions. (t or f)?
long    1
arrow   20:47
clrans
at      22:15
erase   55
holdok
holdno
lowcase
at      21:20
color   ltcyan
answer  t
.       write   CORRECT!
.       calc    tempscor := tempscor + 1
answer  f
.       write   No, the answer is TRUE!
no
.       at      22:15
.       write   PRESS EITHER t or f (press RETURN and try again)!
endarrow
color   brwhite
calc    score := score + tempscor
do      bot2
pause   keys=all
kbranch esc,mainmenu
if      tempscor > 3
.       jump    useok
else
.       jump    usebad
endif

unit    useok
at      7:20
write   GREAT!!!  YOU KNOW HOW TO CARE FOR THE

        PC WHEN IT IS NOT IN USE.  YOU ALSO KNOW
        WHAT TO DO WHEN MOVING THE PC!
at      15:20
write   NOW YOU WILL LEARN HOW AND WHEN TO CLEAN

        THE PARTS OF THE PC.
do      bot2
kbranch space,clncrt
kbranch esc,mainmenu

unit    usebad
at      10:20
write   HIT THE SPACE BAR TO LEARN NEXT ABOUT HOW

        AND WHEN TO CLEAN THE DIFFERENT PARTS OF

        THE PC!
do      bot2
kbranch space,clncrt
kbranch esc,mainmenu

unit    clncrt
colorb  yellow
box     5:5;1:15;filled
colorb  black
box     4:6;2:14;filled
colorb  blue
at      3:17
write   <--- MONITOR
at      10:10
write   If your monitor isn't kept clean, you will have trouble
        reading the information displayed on it.  This can result
        in misinterpreted data as well as eye strain.
do      bot1
pause   keys=space
at      14:10
write   Because monitor screens generate electrical charges, dust
        is attracted to them.
pause   keys=space
at      17:10
write   Be sure to periodically clean the screen with a static-free,
        lint-free cloth or pad.  Additional screen cleaning fluid
        can also be used.
do      bot2
kbranch esc,mainmenu
kbranch space,clnkeys

unit    clnkeys
colorb  ltgreen
box     6:5;1:23;filled
at      2:6
color   black
write   ############### #
        # ############# #
        # ############## #
           ############
colorb  blue
color   brwhite
at      3:25
write   <--- KEYBOARD
at      8:10
write   Keyboards get dirty from fingerprints, oils and dirt from
        your hands as well as dust.  They can also be seriously
        damaged if food or beverages get accidently spilled on them.
do      bot1
pause   keys=space
at      12:10
write   These things can cause keys to stick or internal parts to
        malfunction thus causing data entry errors from the keyboard.
pause   keys=space
at      15:10
write   Use special keyboard cleaning fluid and special swabs for
        cleaning the keys.  Apply the fluid to a cloth or swab --
        not directly onto the keyboard!
pause   keys=space
at      19:10
write   Clean periodically or immediately if there has been a spillage,
        if errors occur or if any keys stick.
do      bot3
kbranch space,clnprint
kbranch esc,mainmenu
kbranch f1,clncrt

unit    clnprint
at      4:17
write   <----- PRINTER
colorb  ltred
box     7:5;3:15;filled
colorb  brwhite
box     5:7;1:13;filled
color   dkgrey
at      4:6
write   ---------
color   brwhite
colorb  blue
at      10:10
write   If the print from your printer isn't legible then you may need
        to change the ribbon or clean the printer.  Use special non-
        alcohol based printer cleaning fluid to do this so that the
        rubber parts don't dry up.
do      bot1
pause   keys=space
at      16:10
write   Dirt on the paper tractors can cause the paper to slip and jam.
        Thus proper cleaning of all printer parts is important.
pause   keys=space
at      20:10
```

```
write   Clean the printer on a regular basis or immediately if any
        problems occur.
do      bot3
kbranch space,clncpu
kbranch esc,mainmenu
kbranch f1,clnkeys

unit    clncpu
colorb  yellow
box     5:10;1:20;filled
colorb  black
box     4:11;2:19;filled
colorb  dkgrey
box     12:5;6:25;filled
colorb  blue
at      8:27
write   <------- HOUSING OF THE COMPNENTS
at      15:10
write   The housing around the components is the plastic around each
        part.  This also needs cleaning from fingerprints, dirt and dus
at      19:10
write   Use lint-free pads and special cleaning fluid for this.  Other
        hard to reach places can be safely cleaned using compressed air
        specially packaged for this use.
do      bot3
kbranch space,clndrive
kbranch esc,mainmenu
kbranch f1,clnprint

unit    clndrive
do      bot1
at      4:27
write   <------ DISK DRIVES
colorb  dkgrey
box     7:5;1:25;filled
colorb  cyan
box     6:17;2:23;filled
colorb  ltcyan
box     5:18;5:22;filled
at      5:19
color   black
write   ---
box     3:18;3:22;filled
at      3:19
write   ---
colorb  blue
color   brwhite
at      10:10
write   The read/write head of a disk drive is like the head of a
        cassette machine.  It floats about a micron away from the
        surface of the disk.  If it doesn't, information can be
        distorted, skipped or destroyed.
pause   keys=space
```

```
at      15:10
write   Many things cause the disk drives to malfunction and need
        cleaning.  Some are dust, dirt, smoke, hairs, fibers and oxides
        from the diskettes.
pause   keys=space
at      19:10
write   Use a disk drive cleaning kit to periodically clean the drives.
        Do so immediately if there are read/write errors.  Kits usually
        consist of a special disk and disk cleaning fluid.
do      bot3
kbranch esc,mainmenu
kbranch space,clnquiz
kbranch f1,clncpu

unit    clnquiz
        choice,2
calc    tempscor := 0
at      2:15
write   MATCH THE PROBLEM WITH THE CORRECT SOLUTION:
color   ltred
at      5:7
write   PROBLEM

        1.  Soda spilled on keyboard
            and keys stick.

        2.  Its hard to read the words
            on the computer screen
            because of fingerprints.

        3.  Computer is missing data on
            disk and giving me "read"
            errors.
color   ltgreen
at      5:44
write   SOLUTION

        a.  Clean monitor with a lint
            free cloth and special
            cleaning fluid.

        b.  Clean disk drive with special
            cleaning kit.

        c.  Clean keys of keyboard with
            special cleaning fluid applied
            to swabs.
color   brwhite
at      18:10
write   FILL IN THE LETTER OF THE SOLUTION THAT GOES WITH THE PROBLEM.
at      20:20
write   1.
at      20:30
```

```
write   2.
at      20:40
write   3.
calc    probnum := probnum + 1
long    1
arrow   20:23
clrans
at      22:15
erase   55
holdok
holdno
lowcase
at      21:23
color   ltcyan
answer  c
.       write   GOOD
.       calc    tempscor := tempscor + 1
answer  (a,b)
.       write   NO
no
.       at      22:15
.       write   CHOOSE EITHER a, b or c (press RETURN and try again)!
endarrow
color   brwhite
calc    probnum := probnum + 1
long    1
arrow   20:33
clrans
at      22:15
erase   55
holdok
holdno
lowcase
at      21:33
color   ltcyan
answer  a
.       write   GREAT
.       calc    tempscor := tempscor + 1
answer  (b,c)
.       write   NO
no
.       at      22:15
.       write   CHOOSE EITHER a, b or c (press RETURN and try again)!
endarrow
color   brwhite
calc    probnum := probnum + 1
long    1
arrow   20:43
clrans
at      22:15
erase   55
holdok
holdno
```

```
lowcase
at      21:43
color   ltcyan
answer  b
.       write   FANTASTIC
.       calc    tempscor := tempscor + 1
answer  (a,c)
.       write   NO
no
.       at      22:15
.       write   CHOOSE EITHER a, b or c (press RETURN and try again)!
endarrow
color   brwhite
calc    score := score + tempscor
at      22:40
write   This is your score so far:
at      22:68
show    score
do      bot2
pause   keys=all
kbranch esc,mainmenu
if      tempscor < 3
.       jump    clnbad
else
.       jump    clnok
endif

unit    clnok
at      5:10
write   VERY GOOD !!! You know what to clean if a problem occurs
        with the PC.
at      9:10
write   Remember to use cleaning products specially made for the PC.
at      12:10
write   Also, always follow manufacterer's instructions for using
        the cleaning products.
at      16:10
write   Let's continue for a few more hints and reminders about
        Hardware Maintenance.
do      bot2
kbranch esc,mainmenu
kbranch space,also

unit    clnbad
at      5:10
write   You didn't get all of the answers right.  The correct answers
        are:
                1. c            2. a             3. b
at      10:10
write   If soda spills on keys -- clean the keyboard!

        If the screen is hard to read -- clean the monitor!
        If there are disk read errors -- clean the disk drives!
at      18:10
write   Now for some more hints and reminders about Hardware Maintenanc
do      bot2
kbranch esc,mainmenu
kbranch space,also

unit    also
at      5:30
write   REMEMBER :
        ----------
at      9:10
write   DON'T -- smoke, eat or drink near the PC.
do      bot1
pause   keys=space
at      12:10
write   DO ----- periodically clean the parts of the PC or immediately
                 if there are any problems or an accidental spillage
                 has occured.
pause   keys=space
at      17:10
write   DO ----- use a surge protector to guard against power spikes.
pause   keys=space
at      20:10
write   DO ----- keep PC away from heat vents, radiators, and direct
                 sunlight.
do      bot2
kbranch esc,mainmenu
kbranch space,sumquiz

unit    sumquiz
calc    tempscor := 0
at      2:10
write   Just to make sure that you know your stuff:
calc    probnum := probnum + 1
at      5:10
write   DO use a _____________ protector to guard against power surges!
long    10
color   ltmagenta
arrow   5:19
holdok
holdno
lowcase
at      7:20
color   ltgreen
answer  (surge,serge)
.       write   VERY GOOD!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is SURGE
endarrow
color   brwhite
calc    probnum := probnum + 1
```

```
at      10:10
write   DO keep the PC away from _________ sources such as direct sunli
        steam vents and radiators.
long    6
color   ltmagenta
arrow   10:35
holdok
holdno
lowcase
at      13:20
color   ltgreen
answer  (heat,heet)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is HEAT
endarrow
color   brwhite
calc    probnum := probnum + 1
at      16:10
write   DO ___________ any part of the PC that starts to malfunction
        or has had a beverage accidentally spilled on it.
long    8
color   ltmagenta
arrow   16:14
holdok
holdno
lowcase
at      19:20
color   ltgreen
answer  (clean,cleen,clen,clene)
.       write   GREAT!
.       calc    tempscor := tempscor + 1
ok
.       write   NO, the answer is CLEAN
endarrow
color   brwhite
calc    score := score + tempscor
at      21:10
write   Your score so far is:
at      21:33
show    score
do      bot2
pause   keys=all
kbranch esc,mainmenu
if      tempscor < 3
.       jump    sumbad
else
.       jump    sumok
endif

unit    sumok
at      3:15
```

```
write   GREAT !!!  ---  Hit the <spacebar> to go to the next

        screen so you can print the results of all of the

        questions you answered.

        THEN, you can continue to the next lesson!
colorb  yellow
box     15:25;11:35;filled
colorb  black
box     14:26;12:34;filled
at      12:28
write   o   o
          v
        \___/
colorb  dkgrey
box     22:20;16:40;filled
colorb  cyan
box     21:32;17:38;filled
colorb  ltcyan
box     20:33;20:37;filled
at      20:34
color   black
write   ---
box     18:33;18:37;filled
at      18:34
write   ---
colorb  blue
color   brwhite
do      bot2
kbranch esc,mainmenu
kbranch space,hrdprint

unit    sumbad
at      5:10
write   SORRY, you didn't get all of the answers correct.  These are
        the correct answers:

        DO use a SURGE protector to guard against power surges.

        DO keep the PC away from HEAT sources such as direct sunlight,
        steam vents and radiators.

        DO CLEAN any part of the PC that starts to malfunction or has
        had a beverage accidentally spilled on it.


               Now press the <spacebar> to go to the next screen
               and print the results of the questions you answered!
do      bot2
kbranch esc,mainmenu
kbranch space,hrdprint
```

```
unit    hrdprint
at      5:7
write   YOU HAVE FINISHED THE HARDWARE MAINTENANCE SECTION OF THIS TUTO

        Hold the Alt key down and press the Print Screen key to
        print the results of your quizes.
at      15:15
show    score
calc    tempscor := probnum - score
at      17:15
show    tempscor
at      15:20
write   CORRECT

        WRONG
pause   keys=all
colorb  magenta
at      24:7
write   <spacebar> to return to the MAIN MENU
colorb  blue
kbranch space,mainmenu
```

APPENDIX L

Instructional Materials Locator Sheet

The instructional computer-based program that was produced in this project is available on floppy disk at the office of the graduate program in Master of Science, in Training and Learning Technology, New York Institute of Technology, Old Westbury, N.Y. 11568. The format of the disk is 5 1/4".

APPENDIX M

Results of Post Learning Questionnaire

Post test questionaire: One-on-one Trials

Please respond to each question by circling:
SA - if you STRONGLY AGREE with the statement
A - if you AGREE with the statement
D - if you DISAGREE with the statement
SD - if you STRONGLY DISAGREE with the statement

1. The lesson was interesting. SA-1 A-3 D-0 SD-0

2. The lesson was the right length. SA-2 A-2 D-0 SD-0

3. The lesson was easy to understand. SA-1 A-2 D-1 SD-0

4. The lesson required a high degree of user interaction.
SA-2 A-2 D-0 SD-0

5. The instructions were easy to understand.
SA-1 A-1 D-2 SD-0

6. The information was useful. SA-1 A-3 D-0 SD-0

7. The information can be used on the job. SA-3 A-1 D-0 SD-0

8. The lesson should be given to all employees.
SA-0 A-2 D-2 SD-0

9. Most PC breakdowns are caused by carelessness or improper maintenance.
SA-1 A-2 D-1 SD-0

10. This lesson will help decrease the amount of PC repairs needed.
SA-2 A-2 D-0 SD-0

Please circle the answers that apply to you:

I am:
male-2 female-2

My age is:

under 20	20-25	26-35	36-45	46-55	over 56
0	1	2	0	0	1

The highest education that I have completed:
1-high school
0-college
1-graduate school
0-doctoral school
1-some college
1-some graduate school
0-some doctoral school

I have been with the company:
0-under 3 years
2-between 3 and 7 years
1-between 8 and 15 years
1-over 16 years

Post test questionaire: Small Group Trials

Please respond to each question by circling:
SA - if you STRONGLY AGREE with the statement
A - if you AGREE with the statement
D - if you DISAGREE with the statement
SD - if you STRONGLY DISAGREE with the statement

1. The lesson was interesting. SA-1 A-3 D-1 SD-0
2. The lesson was the right length. SA-2 A-3 D-0 SD-0
3. The lesson was easy to understand. SA-2 A-2 D-1 SD-0
4. The lesson required a high degree of user interaction.
   SA-3 A-2 D-0 SD-0
5. The instructions were easy to understand.
   SA-1 A-3 D-1 SD-0
6. The information was useful. SA-1 A-4 D-0 SD-0
7. The information can be used on the job. SA-1 A-3 D-1 SD-0
8. The lesson should be given to all employees.
   SA-1 A-2 D-2 SD-0
9. Most PC breakdowns are caused by carelessness or improper maintenance.
   SA-2 A-3 D-0 SD-0
10. This lesson will help decrease the amount of PC repairs needed.
   SA-2 A-3 D-0 SD-0

Please circle the answers that apply to you:

I am:
male-3 female-2

My age is:

under 20	20-25	26-35	36-45	46-55	over 56
0	1	2	0	1	1

The highest education that I have completed:
1-high school
1-college
2-graduate school
0-doctoral school
0-some college
1-some graduate school
0-some doctoral school

I have been with the company:
0-under 3 years
2-between 3 and 7 years
1-between 8 and 15 years
2-over 16 years

Post test questionaire: Field Trials

Please respond to each question by circling:
SA - if you STRONGLY AGREE with the statement
A - if you AGREE with the statement
D - if you DISAGREE with the statement
SD - if you STRONGLY DISAGREE with the statement

1. The lesson was interesting. SA-1 A-4 D-1 SD-0

2. The lesson was the right length. SA-4 A-1 D-1 SD-0

3. The lesson was easy to understand. SA-2 A-4 D-0 SD-0

4. The lesson required a high degree of user interaction.
SA-1 A-4 D-1 SD-0

5. The instructions were easy to understand.
SA-3 A-3 D-0 SD-0

6. The information was useful. SA-0 A-6 D-0 SD-0

7. The information can be used on the job. SA-2 A-4 D-0 SD-0

8. The lesson should be given to all employees.
SA-2 A-3 D-1 SD-0

9. Most PC breakdowns are caused by carelessness or improper maintenance.
SA-5 A-1 D-0 SD-0

10. This lesson will help decrease the amount of PC repairs needed.
SA-2 A-4 D-0 SD-0

Please circle the answers that apply to you:

I am:
male-4 female-2

My age is:

under 20	20-25	26-35	36-45	46-55	over 56
0	2	2		1	1

The highest education that I have completed:
1-high school
1-college
1-graduate school
0-doctoral school
1-some college
2-some graduate school
0-some doctoral school

I have been with the company:
0-under 3 years
4-between 3 and 7 years
0-between 8 and 15 years
2-over 16 years

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